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PENNSYLVANIA
DEPARTMENT OF COMMERCE
STATE PLANNING BOARD



INDUSTRIAL UTILITY OF WATER

PART-I

TEMPERATURES AND CHEMICAL CONTENT AT LOW FLOW

PREPARED IN COOPERATION WITH

UNITED STATES GEOLOGICAL SURVEY

AND

PENNSYLVANIA DEPARTMENT OF FORESTS & WATERS

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COMMONWEALTH OF PENNSYLVANIA

Edward Martin, Governor

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INDUSTRIAL UTILITY OF WATER

Part I

Temperatures and Chemical Content During Low Flow, July-October 1944

Prepared in cooperation with the
Pennsylvania Department of Forests and Waters
James A. Kell, Secretary
and
United States Geological Survey
Glenn L. Parker, Chief Hydraulic Engineer

Issued by
Pennsylvania Department of Commerce
State Planning Board
June 1945

L324459

The State's seven drainage systems must carry off the industrial waste of one of the most highly developed manufacturing areas in the world. But they must also provide good water for 17,000 industries and for 10,000,000 people.

Pennsylvania's most precious natural resource is its water. Without the abundant flow of streams and rivers the growth of the Commonwealth would have been impossible. In every average year more than 138 billion tons of rain water fall on Pennsylvania soil. To maintain the full usefulness of this precious resource is no easy task in a great industrial Commonwealth, yet it is, perhaps, the most important undertaking that can ever be engaged in for the health and welfare of all the people of our State.

Pennsylvania rainfall drains into the sea through seven major waterways. No other State in the Union has so many distinct drainage basins. Some part of this vast flow pours into the Atlantic through Delaware Bay, some into Chesapeake Bay through the Susquehanna, and some directly into the Chesapeake. A part of the surface water of our southern counties flows into the Potomac, a part, in the north, into Lake Erie, a part into Lake Ontario, while the southwest area of the State delivers its water to the Gulf of Mexico down the many tributaries of the Ohio.

To be in a position to supply industry with necessary information as to quality and quantity of water available at any specific point requires precise knowledge as to existing chemical content and rate of flow in our major rivers and in all the important feeding streams. That information is now being gathered for the first time and provision is being made for a continuous study of stream conditions in all of the State's important waterways. Knowledge gained in this survey will also be useful in connection with the State's program for improving its water supply and for the prevention of pollution. This booklet, therefore, records a first step in the important undertaking of conserving one of the State's most vital necessities.

Acts passed by the General Assembly in its 1945 Session dealing with the water supply problems of the Commonwealth are listed on page 10.

Industrial Utility of Water

Complete knowledge of the quantity and quality of our natural waters is a dominating factor which influences the establishment and the expansion of industry. Comprehensive data have been available on yield for many years. However, little information has been collected relating to the chemical character which would determine the suitability of water for industrial purposes or the methods for its treatment.

The Pennsylvania Department of Commerce fully recognized this need and in June 1944 entered into a cooperative agreement with the United States Geological Survey to study the industrial utility of the surface waters of Pennsylvania.

The chemical analyses and temperatures given herewith are for samples of surface waters during low flows July-October 1944. The sampling was done as a part of a cooperative study of the industrial utility of the surface waters of Pennsylvania which is being made by the Pennsylvania Department of Commerce, the Pennsylvania Department of Forests and Waters and the United States Geological Survey. A major part of the comprehensive program provides for the analysis of composites of samples collected daily from a number of streams in the State. Ten daily sampling stations were started October 1, 1944. An analysis for one of the composite periods for each daily sampling station is included with the analyses of the single samples of low flow. Analyses of samples of high flow in 1945 at the same points will be given in a later report.

Suspended sediment or precipitated material was not determined. The quantity reported for dissolved solids is the residue on evaporation after heating at 180° centigrade for one hour. For samples with ph 5.0 or less, aluminum, manganese, and total acidity are reported in addition to the regular determinations. The total acidity is reported as the equivalent sulphuric acid (H_2SO_4), and represents the titrated acidity to the phenolphthalein end point at boiling temperature. Hardness is calculated as the $CaCO_3$ equivalent of all the significant cations except sodium and potassium.

Because the analyses are for single samples, there is no way, at this time, of knowing how closely they represent the composition of the water throughout the year at the various sampling points.

The State Planning Board wishes to acknowledge the invaluable assistance of John W. Mangan, Chief of the Division of Hydrography of the Department of Forests and Waters and District Engineer of the U. S. Geological Survey. Mr. Mangan has directed the collection of water samples and has coordinated the State-Federal activities involved in this cooperative study.

The water analyses were made in the United States Geological Survey laboratory in Washington, D. C., W. D. Collins, Chemist in Charge, Quality of Water Division. The methods are those regularly in use and described in United States Water-Supply Paper 596-H, pages 236-261, 1928; "Notes on practical water analysis" by W. D. Collins. The work in Pennsylvania is under the direct supervision of Walter F. White, Jr., of the U. S. Geological Survey.

Source and Significance of Mineral Constituents in Natural Waters

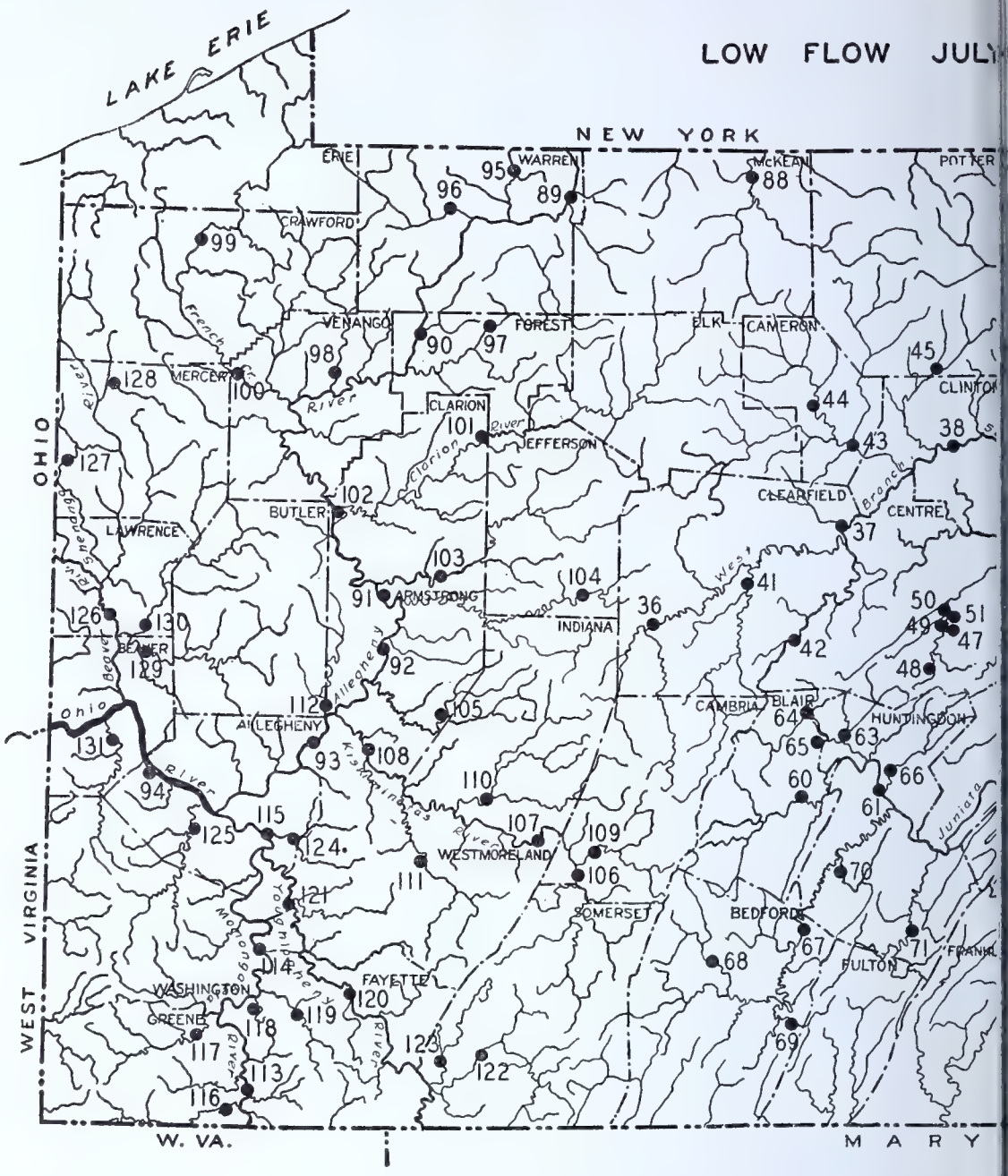
The characteristics and mineral constituents of natural waters here considered include those found in quantities sufficient to have practical effect on the value of the waters for ordinary uses.

Color.—In water analysis the term "color" refers to the appearance of water that is free from suspended solids. Water for domestic use and some industrial uses should be free from perceptible color. Natural color in surface waters is caused almost entirely by organic matter extracted from plants and minerals. A color less than 20 usually passes unnoticed. Some swamp waters have natural color of 200 or 300. At many places, however, high color in water results from industrial wastes.

pH.—The intensity of acidity or alkalinity of a water, as indicated by the hydrogen-ion concentration, is of importance with reference to corrosive properties of water, and to proper treatment for coagulation at water-treatment plants. The symbol pH is commonly used to indicate the hydrogen-ion concentration. It represents the negative logarithm of the number of moles of ionized hydrogen per liter of water. For practical purposes, the pH scale may be used with reference to acidity and alkalinity, as a temperature scale is used with reference to heat conditions. A neutral water has a pH of 7.0. The pH

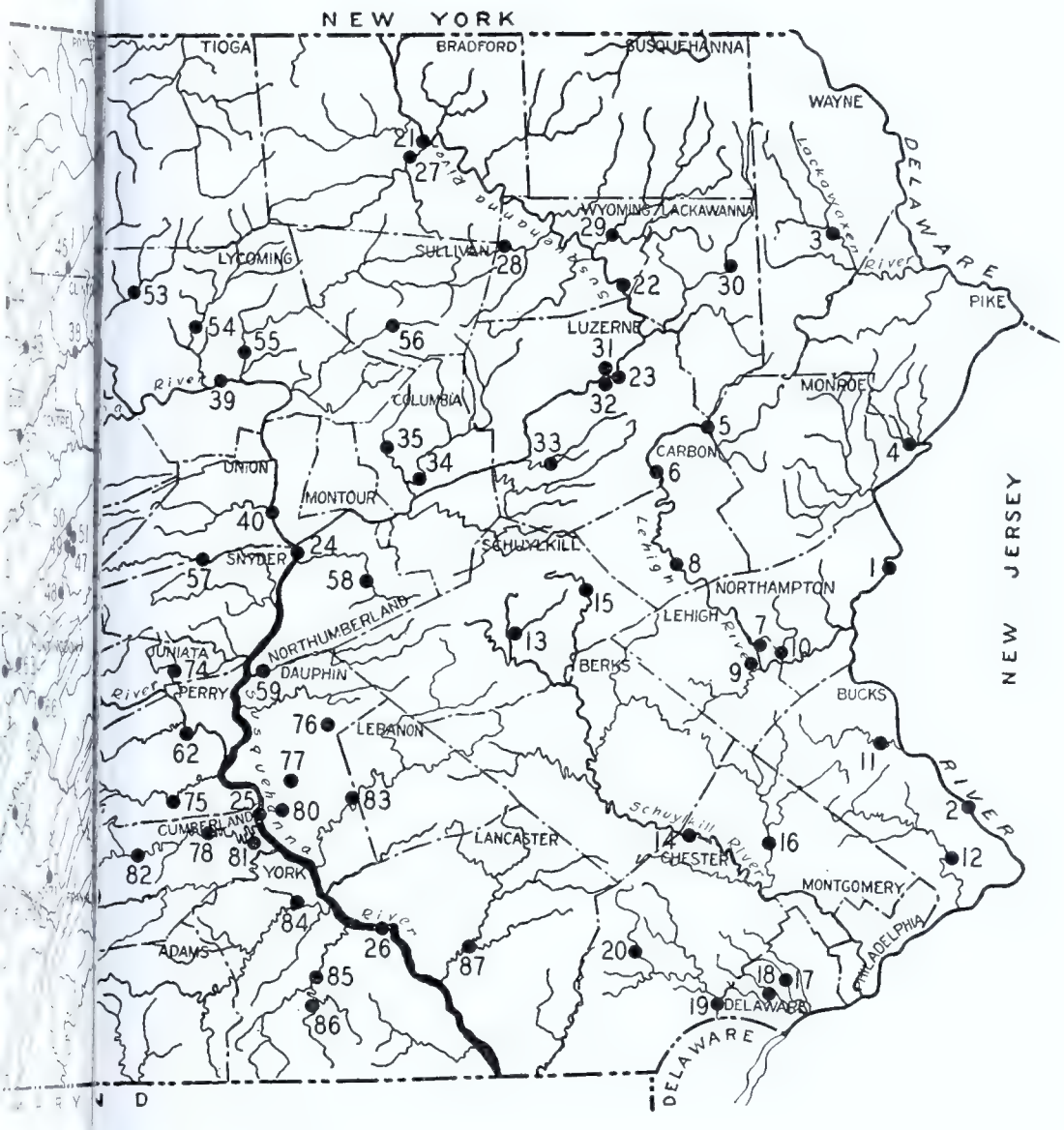
LOCATION OF WATER

LOW FLOW JULY



WATER AMPLING STATIONS

FLOW JUL OCTOBER 1944



PENNSYLVANIA DEPARTMENT OF COMMERCE
STATE PLANNING BOARD

of most natural waters varies between 6.0 and 8.0. Some alkaline waters have pH values greater than 8.0 and waters containing free mineral acid have values less than 4.5.

Specific conductance.—The specific conductance of a water is a measure of its ability to conduct a current of electricity. It varies with the concentration and degree of ionization of the different minerals in solution.

When considered in conjunction with results of determinations for other constituents, specific conductance is a useful determination and plays an important part in following changes in concentration of the total quantity of dissolved minerals in surface waters.

Silica (SiO_2).—Silica is dissolved from practically all rocks. A few natural waters contain less than 3 parts per million of silica and some contain more than 50 parts, but most of them contain from 10 to 30 parts per million. Silica affects the usefulness of a water because it contributes to the formation of boiler scale.

Aluminum and manganese (Al and Mn).—Aluminum and manganese are not regularly determined in the practical analysis of water. However, acid waters may have relatively large quantities of these constituents that can be troublesome to certain users of the waters. Manganese is especially injurious in laundry work, and in textile processing that involves washing.

Iron (Fe).—Iron is dissolved from many rock materials. On exposure to the air water that contains more than 1 part per million of iron soon becomes turbid with the insoluble compound produced by oxidation; surface waters therefore rarely contain as much as 1 part per million of dissolved iron. Some acid waters carry large quantities of iron in solution. Excessive iron causes stains on white porcelain or enameled ware and fixtures and on clothing or other fabrics washed in the water.

Calcium (Ca).—Calcium is dissolved from practically all rocks, but particularly from limestone, dolomite, and gypsum. Calcium and magnesium make water hard and are the active agents in forming boiler scale. Most waters from granite contain less than 10 parts per million of calcium; many waters from limestone contain from 30 to 70 parts; and waters that leach deposits of gypsum may contain more than 100.

Magnesium (Mg).—Magnesium is dissolved from many rocks but particularly from dolomite. Its effects are similar to those of calcium, but waters that contain much magnesium and chloride are likely to be corrosive, especially in steam boilers. The magnesium in soft waters may amount to only 1 or 2 parts per million, but water in areas that contain large quantities of dolomite may contain 20 to 50 parts per million of magnesium.

Sodium and potassium (Na + K).—Sodium and potassium are dissolved from practically all rocks, but they make up only a small part of the dissolved mineral matter in most waters in humid regions. Natural waters that contain only 3 or 4 parts per million of the two together are likely to carry about equal quantities of sodium and potassium. As the total quantity of these constituents increases the proportion of sodium becomes greater. Moderate quantities of these constituents have little effect, but waters that carry more than 50 or 100 parts per million of the two may require careful operation of steam boilers to prevent foaming. Waters that contain large quantities of sodium salts injure crops and some waters contain so much sodium that they are unfit for nearly all uses.

Carbonate and bicarbonate radicals (CO_3 and HCO_3).—Carbonate and bicarbonate occur in waters largely through the action of carbon dioxide, which enables the water to dissolve carbonates of calcium and magnesium. Carbonate is not present in appreciable quantities in many natural waters. The bicarbonate in waters that come from insoluble rocks may amount to less than 10 parts per million; many waters from limestone

contain from 200 to 400 parts per million; and certain waters that contain sodium bicarbonate may carry 1,000 or more parts of bicarbonate per million. The bicarbonate as such has comparatively little effect, although a large quantity may make water unsatisfactory for drinking and other domestic uses.

Sulfate radicals (SO_4).—Sulfate is dissolved in large quantities from gypsum and from deposits of sodium sulfate. It is also formed by the oxidation of sulfides of iron and is therefore present in considerable quantities in waters from mines and from many beds of shale. Sulfate in waters that contain much calcium and magnesium causes the formation of hard scale in steam boilers and many increase the cost of softening the water.

Chloride radicals (Cl).—Chloride is dissolved in small quantities from rock materials in most parts of the country. The chloride in waters has little effect on their use unless it is present in excessive quantities, as in brines.

Fluoride radicals (F).—Fluoride has been reported as present in rocks to about the same extent as chloride. However, the quantity present in natural waters is usually much less than that of chloride. Fluoride in water is known to be associated with the dental defect known as mottled enamel, if the water is used for drinking by young children during calcification or formation of the teeth. This condition becomes more noticeable as the quantity of fluoride in water increases above 1 part per million. It is reported that the incidence of dental caries (decay of teeth) is decreased or prevented by quantities of fluoride that are not sufficient to cause permanent disfigurement from mottled enamel.

Nitrate radicals (NO_3).—Nitrate in water is considered a final oxidation product of nitrogenous organic material. The quantities usually present have no effect on the value of water for ordinary use.

Dissolved solids.—The quantity reported as dissolved solids (the residue on evaporation) consists mainly of the dissolved mineral constituents in the water. It may also contain some organic matter and water of crystallization. Waters with less than 500 parts per million of dissolved solids are usually satisfactory for domestic and most industrial uses. Waters with more than 1,000 parts per million of dissolved solids are likely to be unsuitable for most domestic and industrial uses.

Hardness.—Hardness is usually expressed as the quantity of calcium carbonate ($CaCO_3$) equivalent to the calcium and magnesium present. Water that has less than 50 parts per million of hardness is usually rated as soft and its treatment for removal of hardness is seldom justified. Hardness between 50 and 150 parts per million does not seriously interfere with the use of water for many purposes, but its removal by softening processes may be profitable for laundries and other industries. Water with hardness beyond 150 parts per million usually requires some treatment for removal of hardness before being used.

Total acidity.—The total acidity of a natural water represents the content of free carbon dioxide, mineral acids, and salts, especially sulfates of iron and aluminum, which hydrolyze to give hydrogen ions. Acid waters are very corrosive and generally contain excessive amounts of other objectionable constituents, such as iron, aluminum, or manganese.

RECENT LEGISLATION IN PENNSYLVANIA'S CAMPAIGN FOR PURIFYING THE STATE'S WATER

The following measures affecting the State's water supply were passed by the General Assembly in its 1945 Session.

House Bill No. 1, Act No. 177

Amending the Pure Streams Act of 1937 to prevent the discharge of silt into waters of the Commonwealth and prevent the discharge of acid mine water into clear streams.

House Bill No. 67, Act No. 82A

Appropriating $10,325,000 to the Department of Health for work relating to pollution abatement and prevention, including a share of the cost of plans and construction for sewage or industrial waste treatment plants, sealing abandoned coal mines, acquisition of land and construction of conduits, tunnels, pumps for diversion of acid mine waste and for experimental and research work and other purposes.

House Bill No. 68, Act No. 83A

Appropriating $16,500,000 to the Department of Forests and Waters for purchase and development of forest land and State parks, for construction of dams, stream clearance and a share of cost of plans and construction of plants for experiment and research in methods for treating industrial waste, acid mine drainage and diversion of acid mine waste.

House Bill No. 631, Act No. 50

Ratifying the Ohio River Valley Sanitation Compact for the prevention, abatement and control of pollution of waters in the Ohio River Drainage Basin.

House Bill No. 662, Act No. 123

Promoting interstate cooperation for the conservation and protection of water resources in the Delaware River and providing for the establishment of pollution standards.

House Bill No. 1068, Act No. 441

For dredging and disposal of silt deposits in the Schuylkill River and construction of desilting basins, appropriating $5,000,000 to the Water and Power Resources Board.

House Bill No. 1139, Act No. 405

Creation of a commission to act jointly with commissions of other states to form an Interstate Commission on the Potomac River to cooperate in pollution control and abatement.

Temperatures and chemical analyses of surface waters of Pennsylvania, July-October, 1944

(Parts per million)

DELAWARE RIVER BASIN

DELAWARE RIVER BASIN

Number on Map	Location	Date of Collection	Discharge (second-feet)	Temperature (°F)	Color	pH	Specific Conductance (micromhos at 25°C)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium (Na + K)	Bicarbonate (HCO_3) Radical	Sulfate (SO_4) Radical	Chloride (Cl) Ion Radical	Fluoride (F) Radical	Nitrate (NO_3) Radical	Dissolved Solids	Hardness as $CaCO_3$	Total Acidity as H_2SO_4	Number on Map
		1944																					
1	Delaware River near Richmond	Oct 11-20	1,490	59	8	7.1	142	18	—	.01	—	3.6	4	3.7	25	3	2.0	—	2	44	—	—	1
2	Delaware River at Riverside	Oct 11-20	2,810	59	7	7.2	140	20	—	.01	—	19	6.5	4.5	12	6	2.5	—	4	78	4	—	2
3	Lackawaxen River at Hamlin	Aug 31	109	76	1	6.7	54	6	—	.02	—	7.2	2	2.3	7	4	2.5	—	4	28	4	—	3
4	Hokendauqua Creek at Rhoenesville	July 28	35.4	70	15	6.9	130	9.1	—	.01	—	13	3.4	3.8	4	7	6.5	—	3	70	36	—	4
5	Lehigh River at Stoddartsville	July 29	673	70	25	6.5	132	24	—	.02	—	4.8	3	3.7	7	6	3.5	—	2	70	36	—	5
6	Lehigh River at Tamaqua	July 29	158	76	15	6.6	132	13	—	.01	—	12	4	3.2	4	9	4.0	—	2	70	36	—	6
7	Lehigh River at Catasauqua	Oct 11-20	426	53	9	7.1	212	9.0	—	.05	—	26	7	4.9	7	9	4.0	—	2	110	70	—	7
8	Pohopoco Creek near Parryville	July 28	60.6	76	7	6.3	133	4.9	—	.01	—	8.8	2	2.4	4	7	3.0	—	2	70	36	—	8
9	Jordan Creek at Allentown	Sept 2	26	66	14	7.3	411	6.4	—	.02	—	45	16	7.6	7	7	4.0	—	4	210	150	—	9
10	Monocacy Creek at Bethlehem	Aug 30	34.6	69	8	8.3	356	6.9	—	.02	—	45	16	7.6	7	7	4.0	—	4	210	150	—	10
11	Tohickon Creek near Riegelsville	Aug 26	99	79	15	7.8	229	21	—	.01	—	34	11	7.7	7	8	11	—	3	140	100	—	11
12	Nockamixon Creek near Quakertown	July 29	22.8	70	7	7.2	410	9.9	—	.01	—	88	42	7.6	7	7	4.0	—	2.5	270	210	—	12
13	Perkiomen Creek at Graterford	July 28	463	84	8	8.6	1660	10	19	.06	3.8	—	—	—	—	—	—	—	1.0	—	—	—	13
14	Schuylkill River at Pottstown	Oct 11-20	1,610	61	7	7.7	364	5.2	—	.08	—	68	19	14	7	7	4.0	—	2	210	150	—	14
15	Little Schuylkill River at Tamaqua	July 29	37.7	79	3	6.2	73	8.0	—	.03	1.3	—	—	—	—	—	—	—	—	—	—	—	15
16	Perkiomen Creek near Graters Ford	July 26	65.2	84	4	7.6	215	9.6	—	.02	—	44	16	7.7	7	7	4.0	—	3	140	100	—	16
17	Ridley Creek at Moylan	July 27	4.26	77	5	6.9	132	13	—	.02	—	28	6.4	3.4	7	7	4.0	—	2	70	36	—	17
18	Ridley Creek at Chester	June 22	19.5	76	10	7.2	193	25	—	.02	—	12	5.0	4.1	7	7	4.0	—	4.9	70	36	—	18
19	Brandywine Creek at Chadds Ford	July 25	241	74	8	7.2	178	9.2	—	.00	—	6	2.9	4	4	7	4.0	—	2	70	36	—	19
20	West Branch Brandywine Creek at Coatesville	Sept 5	8.14	70	8	7.4	108	12	—	—	—	—	3.9	4.7	—	—	—	—	—	—	—	—	20

SUSQUEHANNA RIVER BASIN

SUSQUEHANNA RIVER BASIN

21	Susquehanna River at Towanda	July 21	1,870	82	7	7.7	223	10	—	—	—	31	6.9	4.6	—	—	3.5	—	—	78	—	—	21
22	At Falls	Sept 7	1,980	78	9	7.5	221	10	—	.10	—	33	6.3	4.5	—	—	3.5	—	4	78	—	—	22
23	At Bells	Oct 11-20	3,080	58	10	7.8	324	6	—	.01	—	42	9.3	7.9	4	64	5.0	—	4	110	—	—	23
24	At Wilkes-Barre	July 29	2,010	81	10	7.7	310	7.6	—	.03	—	41	8.7	6.3	4	61	4.5	—	3	110	—	—	24
25	At Nanticoke	July 28	3,350	79	4	6.7	160	7.4	—	.00	—	41	11	6.3	4	61	4.5	—	1	110	—	—	25
	Susquehanna River at Harrisburg		7 490																				
25	East channel station 140	Oct 18	—	49	4	8.6	315	—	—	—	—	—	—	—	—	—	22	—	—	210	—	—	25
26	East channel station 800	Oct 18	—	49	3	8.7	308	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	26
27	East channel station 890	Oct 18	—	49	3	8.8	448	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	27
28	East channel station 890	Oct 18	—	50	3	8.8	289	—	—	—	—	—	—	—	—	—	14	—	—	153	—	—	28
29	East channel station 920	Oct 16	—	50	7	8.7	296	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	29
30	East channel station 1140	Oct 11-20	—	55	7	7.9	393	2.6	—	.02	—	21	9.6	31	24	43	7.4	1	5.6	45	17	—	30
31	East channel station 1270	Oct 16	—	50	7	8.6	287	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	31
32	West channel station 800	Oct 18	—	49	3	8.5	295	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	32
33	West channel station 860	Oct 18	—	49	11	7.1	240	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	33
34	West channel station 960	Oct 16	—	50	14	7.4	339	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	34
35	West channel station 1200	Oct 16	—	49	14	7.6	333	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	35
36	West channel station 1260	Oct 16	—	49	7	7.7	303	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	36
37	Susquehanna River at Marietta	Aug 24	3 790	78	8	6.9	187	3.4	—	.02	—	19	6.5	2.8	39	8	3.5	1	1.6	53	—	—	37
38	Towanda Creek near Monmouth	Aug 23	98.8	67	5	6.9	108	2.6	—	—	—	12	2.5	2.3	7	6	3.5	—	1	44	—	—	38
39	North Branch Mehoopany Creek near Lovelton	Sept 1	1.91	70	6	7.4	178	3.1	—	.01	—	21	12	2.0	3.5	39	9.1	3.6	1	2	88	69	—	39
40	Tunkhannock Creek at Eaton	Sept 1	22.1	70	10	7.3	114	8.1	—	.01	—	16	3.6	2.7	14	6	3.5	1	1	70	36	69	40
41	Lackawanna River at Archbald	Sept 10	19.1	68	5	8.5	502	10	7.1	.04	3.0	34	21	7.2	0	231	4.0	1	—	—	—	—	41
42	Toby Creek at Luzerne	Sept 6	3.87	66	14	7.6	119	1.8	—	—	—	19	3.2	3.3	25	6	3.5	—	1	57	—	—	42
43	Solomon Creek at Wilkes-Barre	Sept 6	3.9	66	9	7.7	238	3.5	29	9.4	20	159	93	25	0	197	10.0	1	1	0	0	0	43
44	Wapwallopen River below near Wapwallopen	July 14	17.0	72	9	6.8	68	4.9	—	—	—	5.4	1.5	1.5	14	7	3.5	—	1	44	—	—	44
45	Wapwallopen River near Wapwallopen	Aug 29	4.3	80	—	6.5	124	—	—	—	—	4.2	1.6	4	7	7	4.0	—	2.2	—	—	—	45
46	Fishing Creek near Bloomsburg	July 17	34.6	73	4	7.0	148	16	—	—	—	—	—	—	11	—	—	—	—	—	—	—	46
47	Fishing Creek near Bloomsburg	Sept 2	23.3	66	4	6.8	157	4.8	—	—	—	6.7	1.7	3.7	11	14	3.5	—	1	70	—	—	47
48	Little Fishing Creek at Byers Ferry	Aug 28	2.93	83	8	6.9	67	4.8	—	.03	—	—	—	—	—	—	—	—	—	—	—	—	48
	West Branch Susquehanna River																						
49	At Bower	Aug 7	952	74	6	7.3	123	8.3	4.5	.14	1.1	34	16	2.1	8	26	3.5	—	1.6	61	34	—	49
50	At Karthaus	Aug 9	1,020	75	5	7.3	136	9.0	6.9	.24	1.8	43	17	2.8	8	33	3.5	—	1	70	36	—	50
51	At Clearfield	Aug 31	333	79	4	8.1	308	9.8	9.4	.14	1.2	71	30	4.0	11	74	5.1	—	1	130	84	—	51
52	At Williamsport	July 19	1,180	78	5	6.8	130	6.0	—	.01	—	27	9.5	4.1	4	36	3.5	—	1	44	—	—	52
53	At Lewisburg	Oct 11-20	3 920	58	5	8.3	166	4.4	—	.01	—	—	—	—	—	—	—	—	—	—	—	—	53

Temperatures and chemical analyses of surface waters of Pennsylvania, July-October, 1944

(Parts per million)

SUSQUEHANNA RIVER BASIN—Continued

SUSQUEHANNA RIVER BASIN—Continued

Number on Map	Location	Date of Collection	Discharge (second-feet)	Temperature (°F)	Color	pH	Specific Conductance (Micromhos at 25°C)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium (Na + K)	Bicarbonate (HCO_3) Radical	Sulfate (SO_4) Radical	Chloride (Cl) Radical	Fluoride (F) Radical	Nitrate (NO_3) Radical	Dissolved Solids	Hardness as $CaCO_3$	Total Acidity as H_2SO_4	Number on Map
43	Clearfield Creek at Dimeling	Aug. 5	110	69	5	3.1	45.3	8.4	5.8	.2	1.6	37	14	6.3	0	22	3.0	.2	.8	81	128	78	43
45	Moshannon Creek at Osceola Mills	Aug. 5	63.9	76	5	7.1	121	12	55	2.9	2.4	42	21	6.2	0	53	4.2	0	1.4	155	199	127	45
42	Moshannon Creek at Osceola Mills	Aug. 10	18.0	71	5	7.6	176	26	23	3.4	7.1	59	19	9	0	75	6.1	0	1.5	220	252	203	42
41	Shimmenhorn Creek at Shimmenhorn	Aug. 10	20.9	72	5	3.8	32.5	14	6.1	.16	.9	2.2	1.2	6.6	0	11.6	1.6	.2	1.0	54.5	13.5	69	41
45	Hollywood Branch Moshannon Creek at Stirling Run	Aug. 9	15.1	65	5	7.1	12.6	.70	—	.02	—	1.2	.76	.45	0	.2	.15	1	.15	75	4.1	—	45
46	Kettle Creek near Cross Fork	Aug. 11	7.32	73	5	6.8	64.0	9.1	—	.02	—	6.2	1.5	1.2	0	.2	.15	1	.15	75	21	—	46
46	North Bald Eagle Creek at Beech Creek Station	Aug. 12	167	70	3	7.1	32.6	2.7	—	.02	—	6.9	1.6	1.0	12.6	3.5	2	0	.1	83	19.6	—	46
47	Spring Creek near Axemann	Aug. 10	54.2	69	5	7.6	29.6	5.6	—	.02	—	4.1	1.4	.9	0	7.6	1.5	0	.1	53	16.6	—	47
48	Thompson Spring at State College	Aug. 12	3.25	50	4	7.6	28.6	9.4	—	.01	—	4.1	2.1	1.3	0	12.5	1.2	0	.1	59	19.6	—	48
49	Buck (Benner) Spring near Bellefonte	Aug. 12	5.0	50	3	7.5	27.7	4.8	—	.02	—	5.2	1.6	1.1	0	10.5	1.2	0	.2	62	20.4	—	49
50	Roberts Spring at Fisherman's Paradise near Bellefonte	Aug. 12	5.72	53	3	7.6	26.7	6.8	—	.02	—	4.6	1.2	.8	0	10.1	1.1	0	.1	54	17.4	—	50
51	Kelly Spring near Bellefonte	Aug. 12	15.6	50	5	7.7	27.2	8.0	—	.03	—	5.2	1.4	1.1	0	11.1	1.4	0	.2	65	18.8	—	51
52	Pine Creek at Cedar Run	Aug. 30	13.1	65	4	7.2	12.6	4.4	—	.01	—	1.4	0.3	0.9	0	4.1	1.1	0	.1	35	12.7	—	52
53	Blockhouse Creek near English Center	Aug. 30	2.91	65	4	7.2	13.5	5.2	—	.02	—	1.6	0.3	0.9	0	4.2	1.3	0	.1	37	13.6	—	53
54	Lycoming Creek near Trout Run	July 26	20.2	63	3	6.9	43.0	3.4	—	—	—	5.9	2.4	1.4	0	17.4	2.2	0	.2	83	25.6	—	54
55	Loyalsock Creek at Loyalsock	July 26	103	66	5	7.0	47.0	7.0	—	—	—	6.9	3.4	1.2	0	18.3	3.0	0	.2	91	31.6	—	55
56	Muncy Creek at Sonestown	Aug. 31	2.21	66	7	7.1	4.51	3.9	—	.02	—	1.6	1.2	.6	1.2	.6	.2	0	.2	25	8.5	—	56
57	Penn Creek at Penns Creek	July 17	202	80	5	7.8	155	7.0	—	—	—	21	6.8	—	12	6	3.5	—	2	75	15	—	57
58	Shamokin Creek at Weigh Scale	July 30	67.2	80	5	7.5	125	4.0	.25	.15	.11	19.9	6.5	2.1	0	34.5	4.5	0	.2	133	63	—	58
59	Mahantango Creek East near Dalmatia	July 30	35.3	81	6	8.6	78.6	12.7	0	.03	1.9	18	5.6	1.2	0	27.1	4.1	0	.4	108	54	249	59
60	Penns Creek at Penns Creek	Aug. 9	85.3	86	10	7.3	13.5	0.2	—	0.05	—	4.6	1.4	.3	1.2	1.2	0	0	.1	49	16.4	172	60
61	Penns Creek at Penns Creek Branch, Juniata River at Williamsburg	Aug. 9	2.0	78	10	7.5	49.2	5.1	—	.25	—	6.2	1.4	.5	17.1	2.4	0	0	.1	56	19.2	—	61
62	Juniata River at Newport	Oct. 11-28	699	65	10	7.7	41.5	4.6	—	.21	—	4.9	1.8	.5	15.1	2.2	0	0	.1	46	16.2	—	62
63	Little Juniata River at Spruce Creek	Aug. 10	175	64	20	7.7	47.5	4.4	—	.01	—	4.9	3.8	.6	22.4	2.2	0	0	.1	63	24.4	—	63
64	Little Juniata River at Spruce Creek	Aug. 10	11.5	62	20	7.7	53.6	6.2	—	.03	—	5.6	4.2	.7	25.2	2.2	0	0	.1	70	27.6	—	64
65	Arch Spring at Arch Spring	Aug. 16	14.5	54	3	7.3	23.6	6.6	—	.02	—	3.2	1.2	.5	12.2	1.6	1	0	.1	41	13.6	—	65
66	Standing Stone Creek near Huntingdon	Aug. 9	161	76	5	7.9	34.0	3.4	—	.02	—	5.5	2.3	1.2	14.2	2.9	2	0	.1	62	21.2	—	66
67	Raystown Branch, Juniata River at Huntingdon	Aug. 9	84.6	78	5	7.9	300	2.1	—	.04	—	39	16	9.2	120	65	15.5	0	2	476	163	—	67
68	Trough Creek at Saxton	Aug. 9	16.6	76	5	8.0	24.9	3.4	—	.01	—	4.2	1.2	.7	10.6	3.5	1.5	0	.2	45	14.6	—	68
69	Brush Creek at Saxonville	Aug. 11	8.0	70	10	8.0	6.04	3.9	—	.09	—	1.9	1.1	.5	2.7	2.1	0.5	0	.1	20	10.6	—	69
70	Great Trough Creek near Markleysburg	Aug. 9	2.4	76	4	3.6	56.1	11	9.3	.38	2.3	5.2	1.4	—	0	24.4	1.5	3	2.4	124	22.4	91	70
71	Augbwick Creek near Three Springs	Aug. 10	9.1	71	5	7.4	30.4	3.2	—	.01	—	5.9	2.1	1.3	16.2	1.8	1.2	1	.2	72	20.2	—	71
72	Raystownlick Creek at Everhardts	Aug. 10	50.7	69	5	7.9	27.6	4.4	—	.02	—	4.6	1.9	.9	13.6	1.9	1.0	0	.2	54	18.2	—	72
73	Tuscarora Creek near Port Royal	Aug. 10	4.6	80	5	7.5	21.7	4	—	.02	—	3.6	1.5	.6	11.5	1.6	0	0	.2	39	13.2	—	73
74	Cocolamus Creek near Millerstown	Aug. 10	4.6	75	10	7.8	3.3	2.6	—	.01	—	1.2	.5	.3	3.4	.7	0	0	.1	17	5.2	—	74
75	Sherman Creek at Shermansdale	July 14	22.6	86	5	8.8	16.4	2.2	—	.04	—	2.6	1.9	1.4	6.6	1.3	2.6	1	.9	30.0	14.2	—	75
76	Clark Creek near Carsonville	Aug. 22	7.41	72	12	6.1	3.34	3.5	—	.06	—	2.2	.6	.5	2.6	.9	4.1	0.0	.1	20	8.2	—	76
77	Muddy Creek near Dauphin	Aug. 22	7.91	74	5	7.0	2.27	4.7	—	.02	—	2.4	.6	.5	2.6	.8	3.1	0.0	.1	19	8.2	—	77
78	Conodoguinet Creek at Hogestown	July 14	221	84	5	8.0	29.0	2.6	—	.04	—	5.4	2.3	1.6	12.2	2.1	3.1	0	.2	50	21.2	—	78
79	Big Spring near Newville	Aug. 4	26.0	68	5	7.9	29.6	5.0	—	.02	—	6.6	1.7	.9	16.2	1.5	1.4	0	.2	57	20.2	—	79
80	Paxton Creek near Penbrook	Aug. 10	9.0	78	20	7.4	23.5	7.2	—	.03	—	3.4	1.3	.9	9.2	1.6	1.2	0	.2	38	13.2	—	80
81	Yellow Breeches Creek at Olmstead Mill	Aug. 25	133	61	10	6.4	15.1	7.6	—	.04	—	3.5	1.2	.5	4.1	2.2	0	0	.1	26	12.2	—	81
82	Hogback Springs at Boiling Springs	Aug. 4	14.4	50	5	7.5	22.5	4.9	—	.01	—	3.1	1.2	.6	12.4	1.6	0	0	.1	35	12.4	—	82
83	Hunters Creek at Harper Tavern	Aug. 27	39.8	69	5	7.1	24.4	6.5	—	.02	—	3.2	1.0	.6	10.2	1.2	1.1	0	.1	32	10.6	—	83
84	Conewago Creek near Manchester	Aug. 22	15.6	74	10	7.1	17.1	7.0	—	.05	—	2.5	1.2	.6.1	6.2	1.2	1.2	0	.1	24	10.2	—	84
85	Codorus Creek near York	Aug. 22	21.6	74	1,200	7.3	45.9	5.4	—	.05	—	3.5	2.6	.8.6	10.6	2.9	4.6	—	2	65.1	23.4	—	85
86	South Branch Codorus Creek near York	Aug. 22	2.1	77	8	6.7	10.5	3.1	—	.01	—	2.3	1.0	.4.5	3.4	1.1	0.5	0	3.4	21.0	9.8	24	86
87	Conestoga Creek at Lancaster	July 24	119	74	8	7.5	34.0	4.6	—	.04	—	4.5	1.4	—	17.5	1.9	4.5	0	0.9	70.3	17.7	—	87

a Includes eq. valent of 10 parts per million of carbonate (CO_3)

b Includes equivalent of 5 parts per million of carbonate (CO_3)

c Includes equivalent of 4 parts per million of carbonate (CO_3)

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Temperatures and chemical analyses of surface waters of Pennsylvania, July-October, 1944

(Parts per million)

OHIO RIVER BASIN

Number on Map	Location	Date of Collection	Discharge (second-feet)	Temperature (°F)	Color	pH	Specific Conductance (K × 10⁶ at 25°C)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium (Na + K)	Bicarbonate (HCO_3) Radical	Sulfate (SO_4) Radical	Chloride (Cl) Radical	Fluoride (F) Radical	Nitrate (NO_3) Radical	Dissolved Solids	Hardness as CaCO₃	Total Acidity as H_2SO_4	Number on Map
		1944																					
85	Allegheny River at Eldred	Aug. 25	73	64	0	7.0	74.9	2.9	—	0.02	—	12	2.4	4.4	18	13	19.4	0.1	0.6	118	143	—	85
89	Allegheny River at Kinzua	Aug. 12	220	81	5	7.6	61.9	1.6	—	.07	—	10	2.6	2.2	24	8.8	10.4	2	3	82	117	—	89
90	Allegheny River at West Hickory	Aug. 19	106	82	5	7.6	42.0	1.0	—	.14	—	7.2	1.6	1.9	20	7.2	2.2	1	2	59	72	—	90
91	Allegheny River near Rimer	Aug. 8	1,910	83	10	7.6	78.1	1.9	—	.13	—	20	6.7	2.9	42	6.4	4.4	1	.3	112	107	—	91
92	Allegheny River at Kittanning	Oct. 11-20	2,700	57	15	7.2	27.6	.6	—	.05	—	5.2	1.5	2.1	14	4.6	2.6	0	.4	55	56	—	92
93	Allegheny River at Natrona	Sept. 8	4,700	69	5	7.2	64.4	8.7	4.2	.06	2.0	12	5.0	3.1	24	14	3.2	1	.8	84	83	3.5	93
94	Ohio River at Sewickley	Oct. 12	7,180	56	5	6.7	64.5	5.6	—	.03	—	13	4.3	3.2	24	7.2	2.6	0	.5	84	83	1.1	94
95	Conemaugh Creek at Bissell	Aug. 12	145	74	15	7.2	37.1	7.6	—	.03	—	7.6	1.9	1.3	16	4.4	2.2	0	.1	62	67	—	95
96	Brokenstraw Creek at Youngsville	Aug. 12	40	68	5	7.2	71.6	4.6	—	.04	—	21	5.5	2.1	36	13	2.9	2	1.9	122	103	—	96
97	Tionesta Creek at Mayburg	Aug. 13	31	74	20	7.2	12.0	1.3	—	.01	—	2.6	1.2	1.2	12	4.4	2.4	0	.4	50	38	—	97
98	Oil Creek at Rouseville	Aug. 19	48	78	10	7.2	17.1	1.4	—	.01	—	3.5	1.6	.8	20	2.6	1.2	0	.2	70	46	—	98
99	French Creek at Wayne	Aug. 8	77	78	15	7.6	21.9	2.4	—	.02	—	5.3	1.9	2.4	12	1.8	2.1	2	.6	120	61	—	99
100	French Creek at Utica	Aug. 9	148	78	5	7.2	17.3	1.3	—	.03	—	3.8	1.3	1.9	6.6	4.2	1.8	0	1.4	82	42	—	100
101	Clarion River at Cooksburg	Aug. 14	748	72	35	6.8	46.0	5.7	—	.01	—	11	3.1	4.2	20	12.4	6.1	2	4	131	115	—	101
102	Clarion River at St. Petersburg	Aug. 14	464	67	60	6.8	36.1	7.4	—	.14	—	8.6	2.6	2.6	12	7.2	3.3	2	2	102	84	—	102
103	Redbank Creek at St. Charles	Aug. 14	65	84	5	7.0	24.5	11.6	—	.05	—	4.5	1.5	2.1	14	3.6	1.8	2	1.4	72	53	—	103
104	Mahoning Creek at Punxsutawney	Aug. 4	65	78	5	7.0	29.7	10	—	.05	—	8.5	2.4	2.2	12	6.7	4.2	2	1.4	114	71	—	104
105	Crooked Creek at Idaho	Aug. 3	15	80	5	7.0	247.0	10	4.6	1.5	—	55	20.4	9.2	20	150	2.6	0	1.4	422	220	—	105
106	Piney Creek at Sandy	Aug. 2	33	79	3	7.2	147	6.4	1.6	0.1	0.6	30	7.8	17	0	197	8.0	2	.4	—	182	206	106
107	Conemaugh River at Seward	Aug. 2	241	76	5	7.2	96.7	14	12.1	.27	2.2	19.2	5.4	3.8	0	64	3.6	2	1.2	64.7	106	68	107
108	Chikiminkus River at Vandergrift	Sept. 4	448	71	5	7.2	174	19	15	.33	.07	31.2	7.8	5.6	0	84	4.8	2	1.2	92.4	132	214	108
109	Little Conemaugh River at East Conemaugh	Aug. 2	14	73	5	7.2	222	8.0	29	1.5	1.0	55.2	18	5.6	0	90.0	14	3	3	—	302	245	109
110	Blacklick Creek at Blacklick	Aug. 2	65	77	15	7.0	225	7.2	19	3.2	.92	38	14.4	6.0	0	92.4	22	3	2	—	321	260	110
111	Loyalhanna Creek at Latrobe	Aug. 1	17	75	5	6.8	58.1	5.4	—	.02	—	28	9.0	5.1	6	102	5.9	1	1.4	162	197	—	111
112	Hills Creek near Freeport	Aug. 5	2.65	70	5	7.4	45.3	3.8	—	.01	—	9.6	3.2	1.5	4	20	3.2	1	1.4	70	101	—	112
113	Monongahela River near Greensboro	Aug. 15	3,140	82	7	7.2	65.8	3.9	6.8	1.3	1.2	15	4.3	3.5	0	71.4	10	2	1.3	108	131	24	113
114	Monongahela River at Charleroi	Oct. 11-20	2,420	57	5	7.4	78.1	6.0	1.5	.7	.26	19.2	7.2	2.5	0	84	5.6	1	.8	104	136	5.4	114
115	Monongahela River at Braddock	Sept. 9	1,430	80	5	7.4	99.4	12	5.0	2.6	0.2	22	7.2	2.5	0	121	7.0	2	1.4	148	170	12.4	115
116	Dunkard Creek at Shannopin	Aug. 15	7.3	83	4	7.4	130	11	5.2	.24	4.2	103	40	9.3	0	278	45	7	1	391	454	43	116
117	South Fork Dunkard Creek at Jefferson	Aug. 15	1.22	76	10	7.2	49.5	3.4	—	.07	—	13	3.6	4.6	0	13.6	7.2	1	1.6	73	53	—	117
118	Dunkard Creek at Alilene	Aug. 17	12	69	5	7.2	204	2.5	—	.01	—	53.2	17	22.6	0	216	15.2	1	1.8	2.26	214	3.6	118
119	Pedricktown Creek at Hughart	Aug. 17	29	72	35	6.8	242	5.7	13	1.27	.10	24.8	9.7	12.8	0	84	15.2	1	1.8	227	164	—	119
120	Youghiogheny River at Connellsville	Aug. 17	316	81	4	6.6	12.7	2.9	—	.02	—	13	3.4	3.2	4	43	2.8	1	1.8	77	46	—	120
121	Youghiogheny River at Sutersville	Aug. 18	254	77	5	7.2	77.7	7.0	5.0	.16	1.2	14	4.8	2.7	0	98.8	14	3	3	142	163	22	121
122	Casselman River at Markleton	Aug. 18	64	77	5	7.4	47.7	4.6	5.2	.16	4.2	14	4.8	2.7	0	87.8	4.2	2	1.0	78	78	2.0	122
123	Laurel Hill Creek at Ursina	Aug. 18	27.5	82	5	7.1	6.46	9	—	.01	—	3.1	1.2	1.2	2.2	11	3.2	1	1.2	40	30	1.2	123
124	Turtle Creek at Trafford	Sept. 9	3.31	68	25	8.4	115	7.5	13	3.6	.20	25	6.7	4.7	0	156	8.5	1	6	2.10	1,200	—	124
125	Chartiers Creek at Carnegie	Sept. 8	67	64	55	7.6	219	20	31	11.2	7.2	156	73	16.7	0	1,170	94	—	—	1,1	1,1	—	125
126	Beaver River at Wampum	Aug. 20	640	66	10	6.6	43.7	4.0	—	.01	—	12	4.5	1.6	0	131	29	0	0	74	134	7.6	126
127	Shenango River at Greenville	Aug. 7	230	76	5	6.7	51.5	2.8	—	.05	—	13	5.1	4.3	0	156	7.6	1	1.2	142	168	12	127
128	Little Shenango River at Greenville	Aug. 7	36	77	10	7.5	92.8	5.4	—	.04	—	34	7.6	1.5	0	196	26	2.6	0.2	127	127	4.8	128
129	Conoquenessing Creek at Harmony	Aug. 6	3.78	67	5	6.7	103	7.0	—	.02	—	19	6.4	1.7	0	84	11	1	0.2	95	95	2.4	129
130	Slippery Rock Creek at Wurtenburg	Aug. 31	45	68	9	7.7	44.2	2.8	—	.02	—	14	4.1	1.1	0	92	9.6	2	1	—	—	—	130
131	Raccoon Creek at Moffatts Mill	Oct. 12	29	55	—	4.0	117	—	—	1.8	—	1.2	4.9	6.9	0	0	52.8	0	—	5	167	84	131

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DOCUMENTS SECTION

RECENT INDUSTRIAL TRENDS AND NEW EMPLOYMENT OPPORTUNITIES IN PENNSYLVANIA

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All data on employment and industrial production used as a basis for the trend charts and location maps in this publication were derived from the records and reports of the Pennsylvania Department of Internal Affairs.

Part I

INDUSTRIAL TRENDS

1916 - 1942

Studies* of Pennsylvania's industrial trends throughout the 20th Century uniformly reveal a fact which is apparently, but not actually, discouraging as to the future. The fact is unquestionable. In 1899, Pennsylvania manufacturing wage earners were 13½% of the total manufacturing employment in the United States. By 1939 this proportion had gradually shrunk to 10.6%. During the same forty-year period Pennsylvania manufacturing wages had declined from 14.8% to 10.9% of the United States total and the value of product from 14.5% to 9.6%. Far from being a portent of industrial decline in the Commonwealth these percentage figures are, in fact, merely evidences of the growth and industrial development of our Nation as a whole. In the first forty years of the 20th Century the population of the United States exhibited an astonishing increase through the settlement of vast areas in the West and the growth of large cities along the Pacific coast. Pennsylvania, among the oldest of the States in population history and the earliest in extensive industrial development, has contributed very largely to the settlement of other areas in our Nation and by doing so has maintained a rising standard of living over the past 200 years. No Pennsylvanian would wish to deny the benefits which have accrued to our State's own industries from the industrial developments in

* Such as: Industrial Trends in Pennsylvania since 1914, Pennsylvania State College Bulletin No. 11 by Carl William Hasek, Ph.D., George Leland Leffler, Ph.D., and Richard Hadly Waters, Ph.D.

other areas in our Country. During this span of years when our proportion of the National production declined from 14½% to 9.6% the actual value of Pennsylvania's products rose from $1,650,000,000 in 1899 to $5,500,000,000 in 1939, a depression year. From this total is excluded the large railroad repair shop production of Pennsylvania and the output of all its mines and quarries.

Of far greater significance than any changes in the proportion of Pennsylvania's production to that of the Nation as a whole is the actual rise and fall of the various types of industry important to the State's economy. What is Pennsylvania's true position in regard to those many types of manufacturing on which her prosperity is certain to depend in the years to follow this great war? Have our industries as a whole lagged behind the current of the times, or maintained the progressive character which gave the State such an undisputed dominance in the early development of so many branches of American industry? Have we assumed our proper place in supplying the vital products demanded by modern life as we approach the midpoint in the 20th Century? Have we successfully modernized, diversified, and readapted our products since the period of the First World War in order to use most efficiently our great natural advantages of raw materials, labor, and access to markets? If at any point the answer to these questions is no, it is not enough, in view of the serious problems which lie ahead of all industry, to offer merely a negative criticism of our past procedures. It is important for us now to determine just where in our State new types of manufacture are necessary for the security of our labor and just what types of manufacture are most important for the years which lie ahead.

GROWTH OF THE STATE'S ENERGY OUTPUT

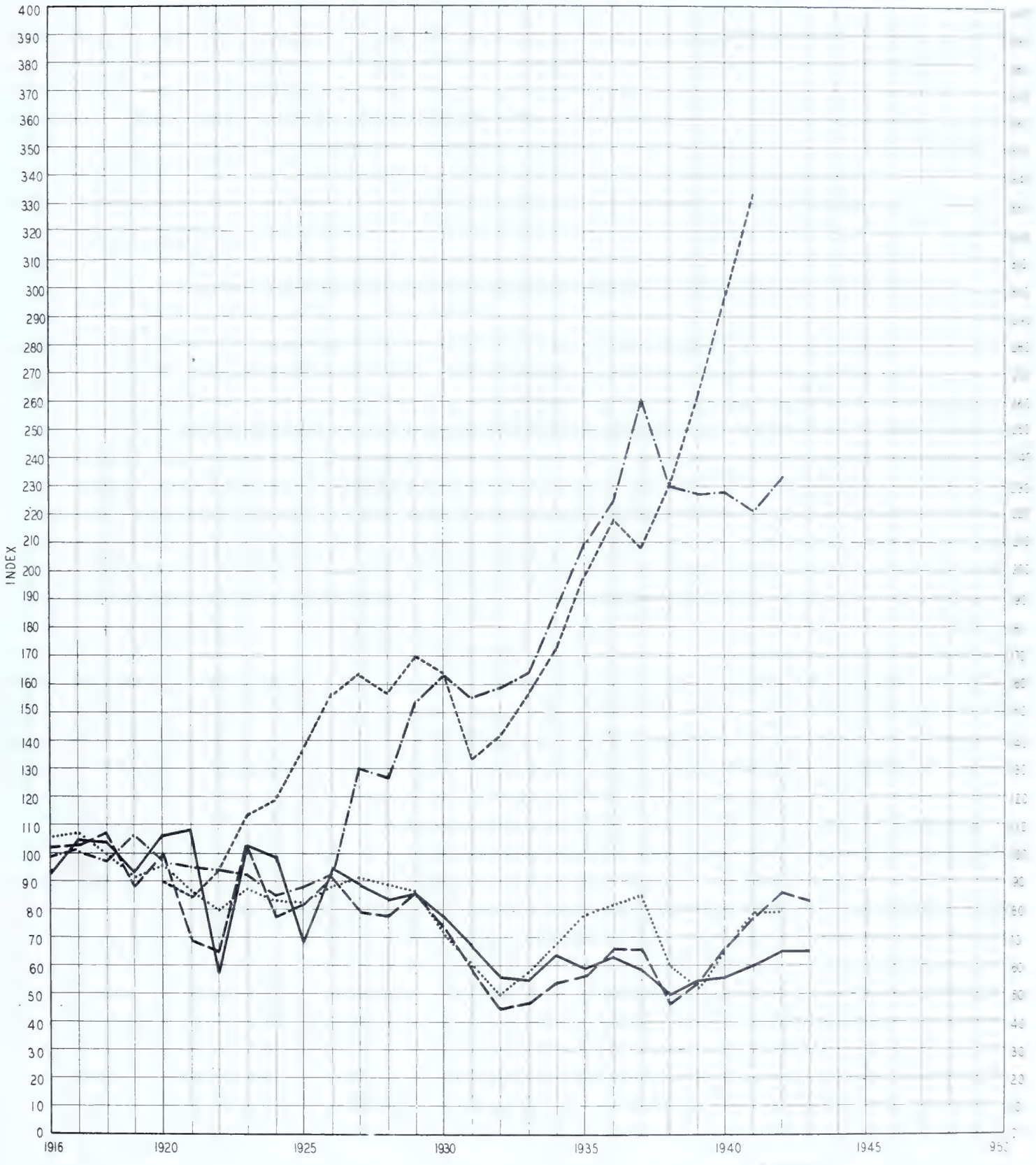
1916 - 1942

In a world experiencing such huge and unexpected stresses as have been developing within the past three years, the prediction of future changes is a task of enormous difficulty and any conclusions based altogether on the past are subject to unusual doubt. This does not, however, mean that Pennsylvania industry, as a whole, or for any particular type of manufacture, is left entirely in the dark as to its prospects, for that would be far from true. The past records of changes in any line of industry must be looked on as the resultant of economic forces which are normally extremely persistent. The dominance of steel in the western part of our Commonwealth, for instance, is due to economic and geographic factors. that no war or succession of wars would be likely to alter over a long term of years. Making due allowance for the effects of periods of prosperity and depression and of war and peace, the long term trends of most of our major industries are still safe indices as to their prospects for the next decade or even longer.

This fact may be best illustrated by an examination of the chart on which the coal, petroleum, natural gas, and electric power production of Pennsylvania since 1916 are reduced to a series of index numbers. Since energy production and energy resources are of fundamental importance in an industrial age, the lines in these charts are well worth study. It is clear, at once, that since the period of the First World War three sources of Pennsylvania's industrial energy have exhibited a gradual decline while two other sources have remarkably risen in economic importance. The production of petroleum from Pennsylvania's oil wells has increased quite notably in the past twenty years and is now two and one-third times as great as it was during the period of the First World War. The production of electrical energy in that same period has multiplied approximately three times. On the other

INDICES OF COAL, PETROLEUM, NATURAL GAS AND ELECTRIC POWER PRODUCTION IN PENNSYLVANIA

(BASE: 1916 TO 1920 YEARLY AVERAGE)



DATA SOURCE:

ANTHRACITE ——— PA. DEPT. OF INTERNAL AFFAIRS
BITUMINOUS COAL ——— PA. DEPT. OF MINES.
PETROLEUM, NATURAL GAS ——— U.S. MINERALS YEARBOOK.
ELECTRICAL ENERGY — FEDERAL POWER COMMISSION.

LEGEND

BITUMINOUS COAL
PETROLEUM
ANTHRACITE
NATURAL GAS
ELECTRICAL ENERGY

hand, our output of hard and soft coal and of natural gas is lower than at any time since the late '20s.

A closer examination of the trends of the five lines on the chart reveals the fact that as to electric power production there is no indication that an upper limit has yet been attained, despite the fact that this curve will undoubtedly show a considerable recession during postwar conversion from military to civilian production. The curve of petroleum production which attained its highest point in 1937 does, however, give evidence of having reached a ceiling at which it will level off and from which it must eventually decline. For the past six years, despite rapidly increasing industrial demands, the output of Pennsylvania grade crude oil has remained more or less stable, and while additional wildcatting in that field and further application of modern water-flooding extractive methods, or a large relative increase in price for Pennsylvania oil might temporarily increase the output, the probabilities are that such increase would be attained only at the expense of later production.

The curve of bituminous coal production, which was at its all-time peak during the base period of this index series, declined sharply in 1921 and 1922 as a result of a coal strike and a business depression, mounted again close to its all-time maximum, and then declined again sharply to 1932. A careful examination of the trend of this line would seem to indicate that between 1932 and 1938 Pennsylvania bituminous coal had reached bottom in its curve of production and that is is now giving evidence of a healthy recovery. Much of this recovery is doubtless due to the stimulation of war on the State's heavy industries, but other factors which would seem to promise a long term rise in soft coal consumption are the development of a large class of commercial and industrial coke oven by-products, and also the dominant importance of soft coal as a source of electrical energy. A similar conclusion may be reached on the basis of these trends as to the future importance of

natural gas in the State's economy. Primarily a source of heat energy, natural gas has become, of late years, of increasing importance as a raw material for various organic products, including synthetic ammonia and the more volatile constituents of high octane motor fuel.

Of all the State's energy resources anthracite has suffered, in this quarter of a Century, the most violent fluctuations in production and has, in the past five years, made the slowest recovery toward its 1916 level. Since anthracite is not primarily an industrial fuel the impact of war has directly affected its production only through the scarcity of competing fuels. It is significant, however, that with a diminishing employment, shared by all other mining industries, anthracite output is now at a level it had not attained at any time within the past twelve years. New methods of firing, the improvement of anthracite burning furnaces, and of the services rendered to anthracite users, even prior to the period of oil shortage, seem to have checked its downward trend and to offer a fair prospect that over the course of the next ten years Pennsylvania's hard coal industry may develop a moderate but healthy progress.

The bearing of these trends on the general pattern of industry is unmistakable. The continuous growth of the use of electrical power is not yet fully reflected in the American industrial pattern. While steel production, glass manufacture and all other types of industry dependent directly on the heat units, or hydrocarbon content, of coal or natural gas are certain to remain as close as possible to the sources of the necessary raw materials, many of the motives which led to the concentration of other types of manufacture have disappeared with the coming of high-tension electrical transmission. While the industries of Pennsylvania have fortunately been spared the effect of bombing raids it is fairly certain that other causes may diminish the tendency of large industries to huddle together along the waterfronts of crowded cities. The effect of that significant rise in electrical energy production, which makes the industrial picture of 1944 so different from that

of 1918 will almost certainly become slowly apparent in the decentralization of many types of manufacture, with the consequent improvement of living conditions for workers, and a gradual decline in the traffic congestion which has frequently slowed the rate of industrial production and added to its cost in the past.

Part II

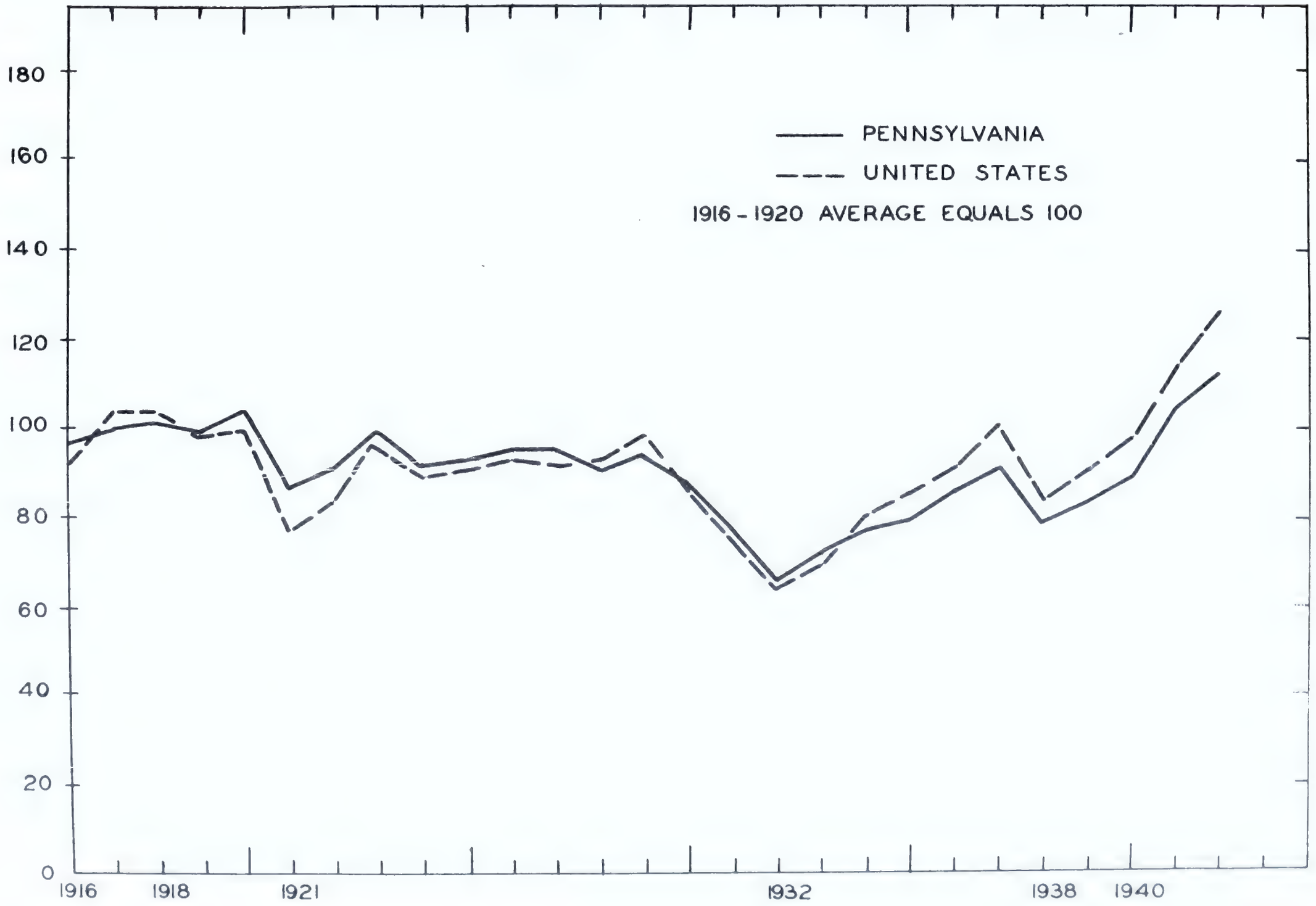
PENNSYLVANIA EMPLOYMENT

The Over-all Picture and the Future Prospects

An examination of this chart of Pennsylvania's total industrial employment compared with that of the United States as a whole reveals the fact that while Pennsylvania experienced an immediate post-war boom in 1920, it did not suffer so extreme a postwar depression in 1921 and 1922 as that experienced by the Nation.

Pennsylvania manufacturing employment did not rise so high as that of the United States during the industrial boom between 1925 and 1929. As a matter of fact, industrial employment somewhat declined during that period, but again the State did not sink so low in employment during the 1932 collapse. Following that collapse Pennsylvania seems again to be repeating its former pattern. Employment did not rise so high in 1937 as in all American industry but the collapse in the 1938 depression was not so sharp. In general, it may be said that Pennsylvania industrial employment, over the course of the past twenty-six years, presents a somewhat more stable picture than that of the Country as a whole. Considering the fact that a very large part of our war industry is merely a modification of products produced in the Commonwealth during the years of peace, the probabilities favor the continuance of this condition in the immediate future. Since our rise in employment due to war industry has been accomplished more than has been usual elsewhere through the re-employment or continuous employment of workers in established industries, the State would be likely, under normal conditions, to present in the reconversion period a somewhat more favorable employment picture

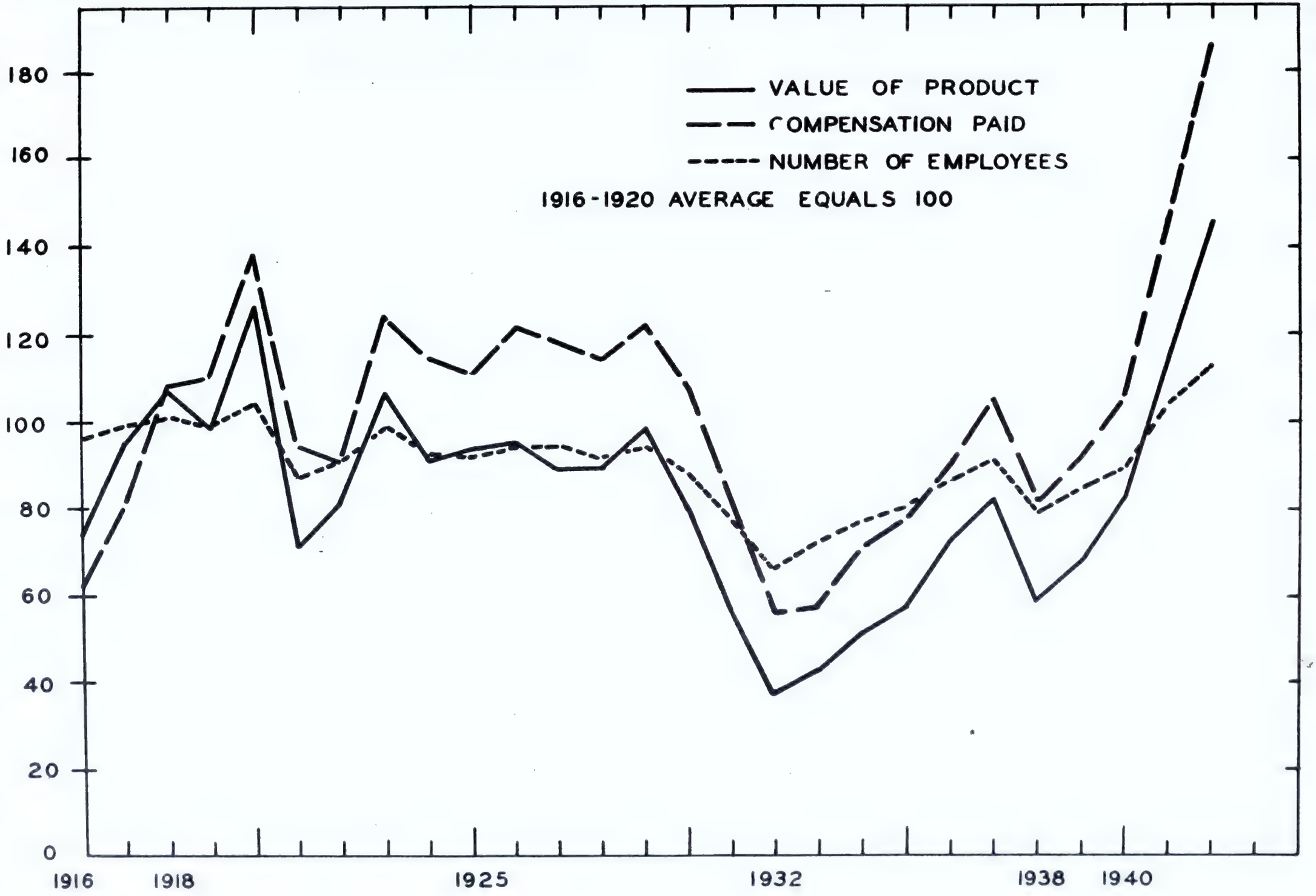
INDICES OF EMPLOYMENT
MANUFACTURING AND MINING INDUSTRIES



than does the entire Nation.

Less favorable is the fact that much of our normal industrial employment is in the production of primary metals and machinery, activities which are among the first to feel the effect of any general reduction in employment. On the demand for these primary metals also depends an important part of the production of our coke ovens and of our bituminous coal mines.

INDICES OF PENNSYLVANIA EMPLOYMENT
MANUFACTURING AND EXTRACTIVE INDUSTRIES



Employment By Industries

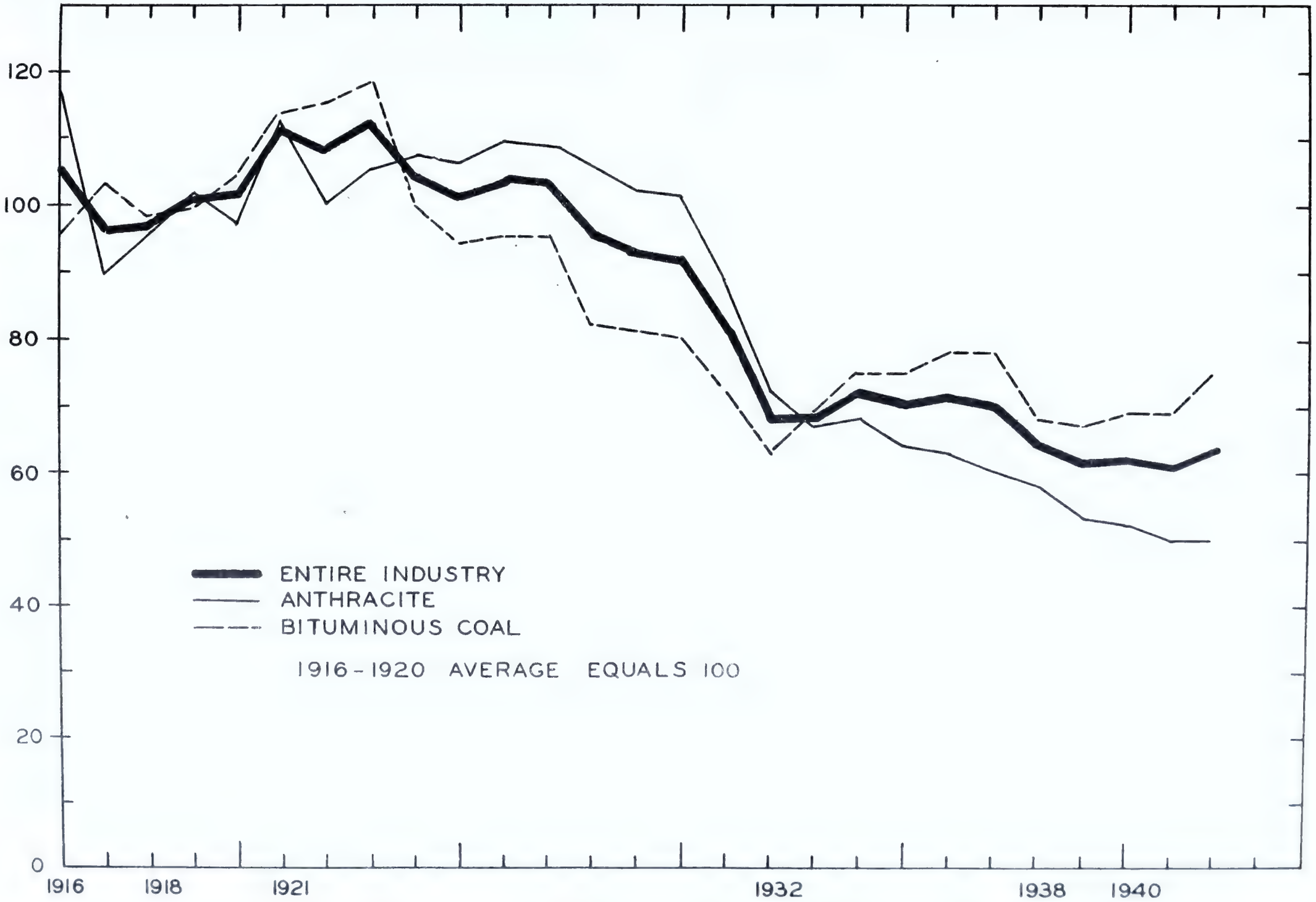
1916 - 1942

In viewing the accompanying charts, illustrating employment changes in the larger classes of Pennsylvania industry, it will be seen that in two of these industrial groups, Mines and Quarry Products and the Tobacco Industries, the State suffered a considerable decline. In the Food, the Textile, and the Paper and Printing Industries the rise has been steady and significant. Greater irregularity and a less certain trend is evident in the remaining larger industrial classes, all of which experienced a severe depression in 1932, and have enjoyed steady or intermittent improvement climaxed with a sharply rising curve since 1940. It is important to us to consider now some of the factors which have influenced these trends of employment over the past twenty-six years.

MINING

The decline in our State employment in the Mine and Quarry industries follows very closely the National picture. The gradual mechanization which has occurred in the State's soft coal mines has led to a steady increase in the tons of coal produced per man day and per man hour. A similar, though less striking, rise has occurred in anthracite which is in part accounted for by the increase of stripping operations. Demand is, of course, a determining factor as to volume of production and employment, and in the past quarter of a century several factors have operated simultaneously to diminish the coal requirements in the Nation as a whole. Among these is the greatly increased efficiency in the use of fuel energy in electric power production, in steam locomotives and in stationary steam engines during the past twenty years. A steady and considerable progress has also been made throughout the 20th Century in the recovery of the various by-products

INDICES OF PENNSYLVANIA EMPLOYMENT
MINE AND QUARRY PRODUCTS



of the coke ovens, and in the decline in the weight of coke necessary for the production of a ton of steel. The evidence is clear from the various curves of the accompanying charts that with a decidedly lower fuel consumption more electric power is being generated and more manufactured goods produced than was ever possible in the past. Within a period of twenty-six years there has also been a marked increase in the use of petroleum both as a raw material for chemical products and as a source of heat energy in many of the fields which, even so late as 1916, were exclusively in the possession of bituminous coal and anthracite.

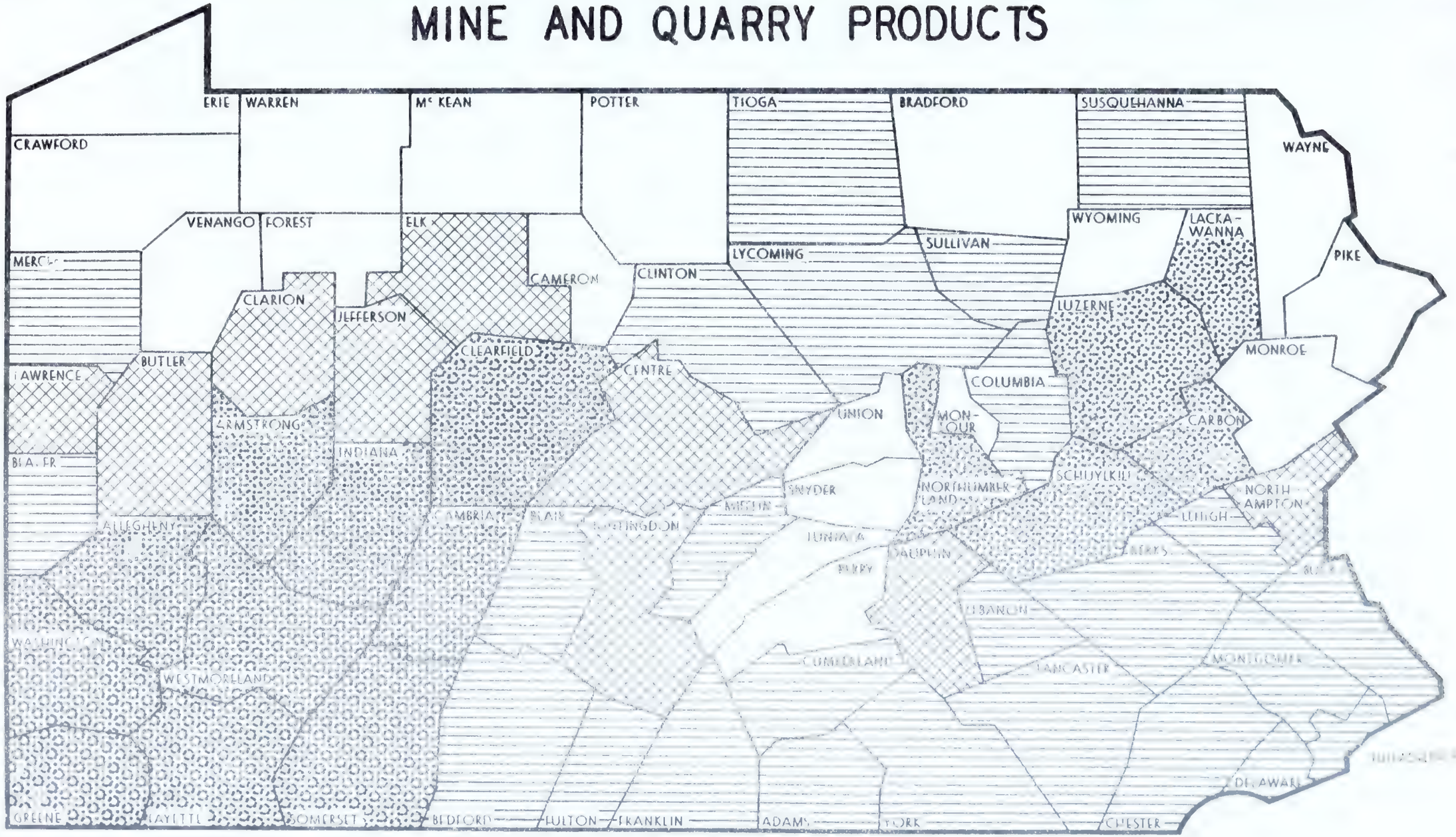
Other factors have operated directly against the coal industries of Pennsylvania. These have been the differential in wage rates between the northern coal mines and those in the south and a freight rate structure which has enabled coal producers as far west as Kentucky to deliver their products to the New England markets via Hampton Roads at a lower hauling cost than is possible for Pennsylvania mines. Decline in employment in the State's mines was, therefore, inevitable. Any rectification of the inequities in labor cost and freight rate structure should enable the soft coal producers of Pennsylvania to regain some part of that export and tide water trade which has been lost to the mines of the south.

It is also to be remembered that since the beginning of the Second World War we have, for the first time in our National history, been confronted with the fact that America's oil reserves are not unlimited and that the precious and unique characteristics of petroleum products, of such overwhelming importance in a period of war, may have to be conserved more rigorously in the future than they ever were in the past. Future prospects, therefore, seem to be that employment in the State's coal mines, barring a serious economic depression, is somewhat on the up-grade.

Such progress, however, cannot come merely as a result of external economic forces. If the State's soft coal industry is to increase its output in the future, either in the high or low volatile fields, this result can come about only through

1940-41

MINE AND QUARRY PRODUCTS



MORE THAN 4,000 EMPLOYEES

1,000 TO 4,000 EMPLOYEES

100 TO 1,000 EMPLOYEES

LESS THAN 100 EMPLOYEES

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

a direct attack on certain of the handicaps which operate adversely to Pennsylvania progress, such as the unduly high ton-mile rail rates to tide water as compared with the southern fields, the abolition in the wage rate differentials between Pennsylvania and the Kentucky and southern West Virginia fields, and the further development, in the Pennsylvania area, of chemical and manufacturing industries making full use of bituminous coal by-products.

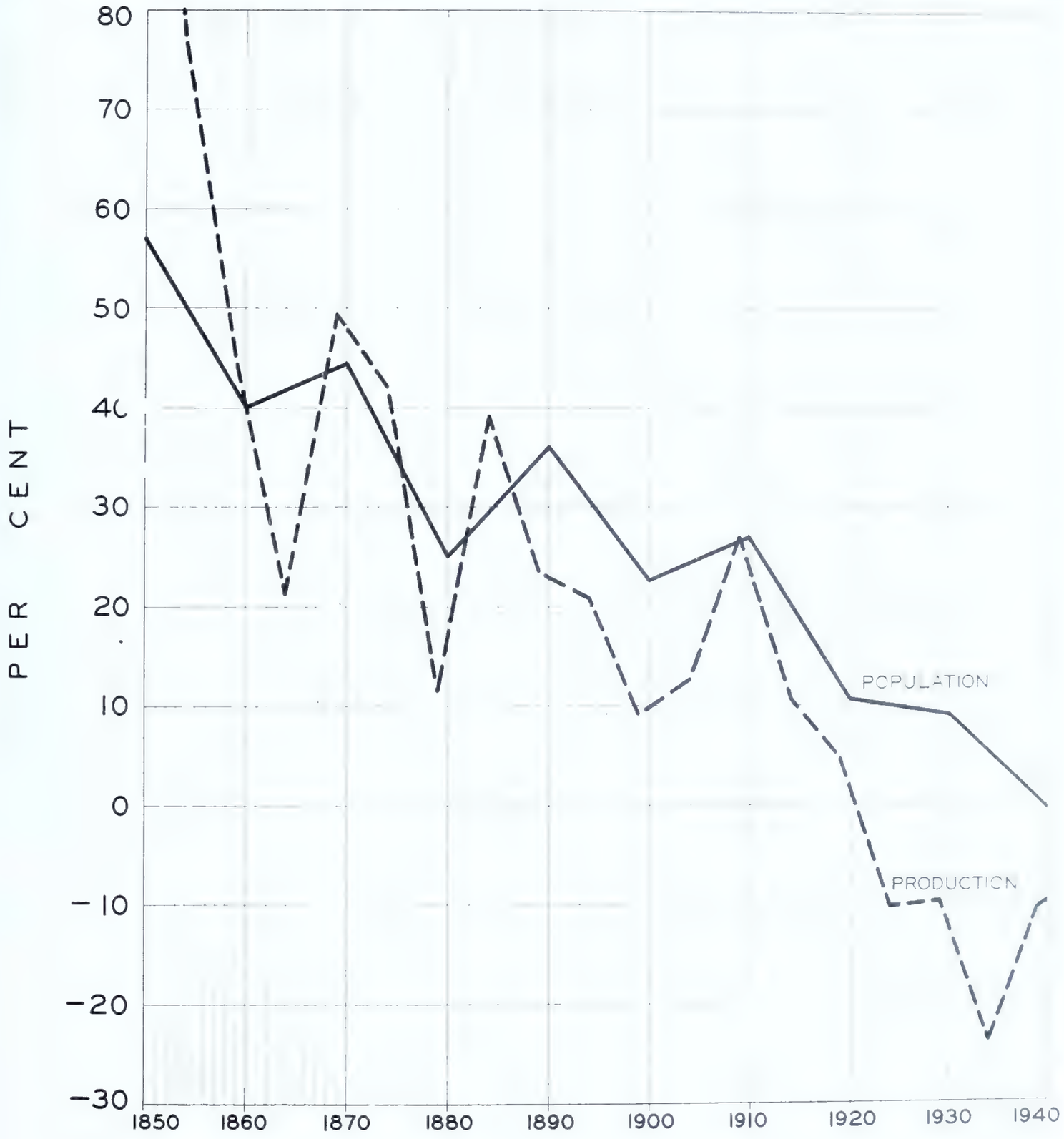
Further progress in anthracite mining depends very largely on the enterprise and success of that industry in maintaining a favorable price structure as compared to competitive fuels through a reduction in hauling and handling costs, the extensive sealing of abandoned mines to reduce water pumping costs, and further improvements in the comparative convenience of domestic heating through the use of hard coal. This must necessarily include improvement of dealer's service to hard coal users, the simplification of stoking devices and further research to discover profitable industrial uses for the smaller sizes of anthracite.

If these lines of effort are followed through, the long-term outlook appears more favorable today than at any time during the past twenty years.

It will be evident, however, from an examination of the employment chart following page 9 that while employment in bituminous coal production gives every evidence of being on the up-grade, anthracite employment has continued to decline even during a period of recovery from the depression years of the early '30s. Any marked improvement in this condition will obviously require extremely energetic action on the part of all those interested in the prosperity of the industry and of Pennsylvania's hard coal counties.

The accompanying chart illustrating the effect on population growth in the hard coal counties of the changes in anthracite coal production will make it abundantly clear how important to the people of those counties are the rises and falls in the demand for their major product. The failure of the population growth-

POPULATION GROWTH RATES IN SEVEN ANTHRACITE COUNTIES AND PERCENTAGE CHANGE IN ANTHRACITE PRODUCTION 1850 — 1940



COAL PRODUCTION GROWTH RATES AT FIVE YEAR INTERVALS

POPULATION GROWTH RATES AT TEN YEAR INTERVALS

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

rate curve, to respond so closely in the past twenty years to the curve of anthracite production is evidence of the increased diversification of industry occurring in many sections of the hard coal field. No doubt some part of the problems of that area of our State may be solved through further industrial diversification, but for many years in the future the prosperity of the anthracite industry will still remain the dominant influence on the economic welfare of at least four of Pennsylvania's counties.

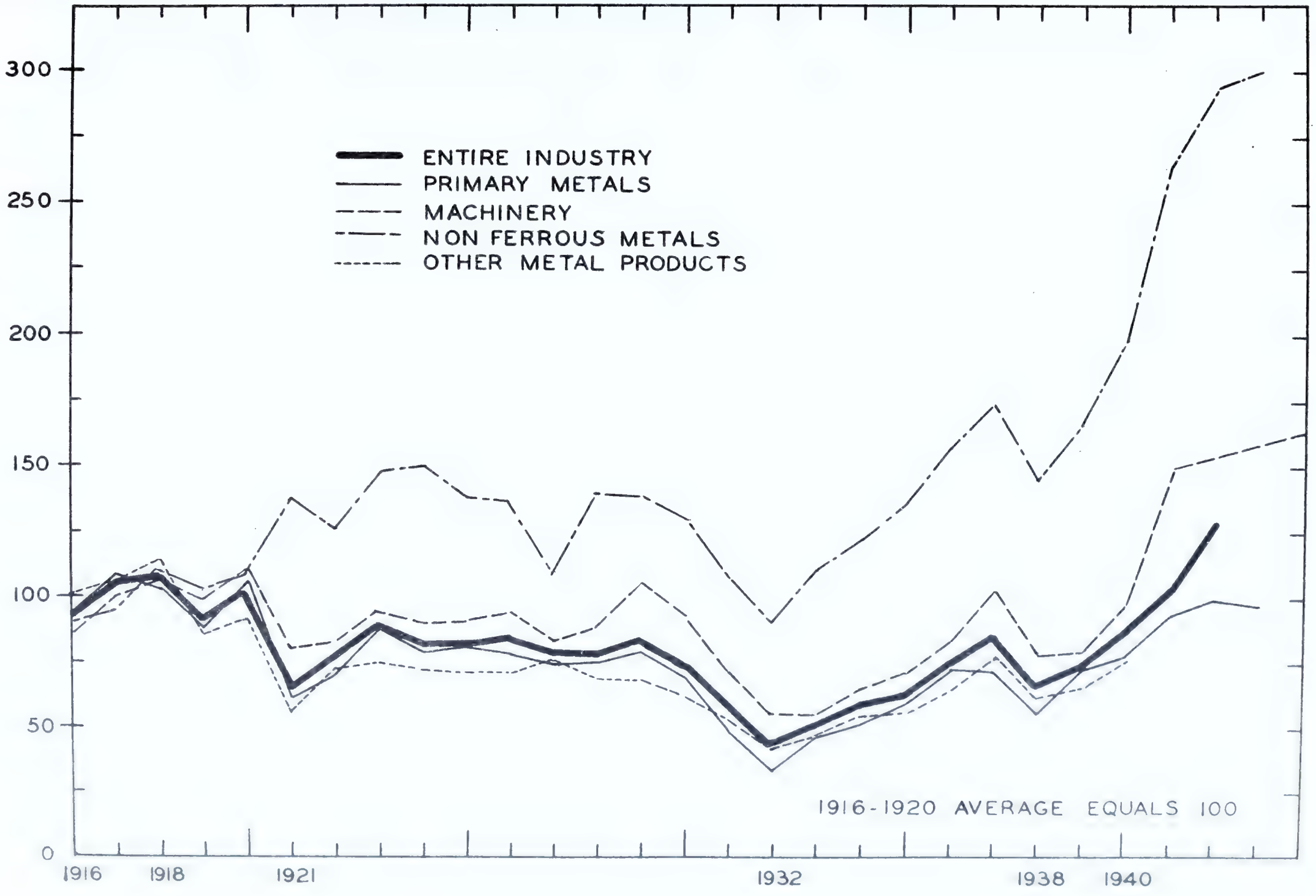
Labor costs in the Pennsylvania bituminous field are somewhat higher per ton than in other competing districts due in large measure to the greater age of the Pennsylvania workings, the depth of the operations, and the width of the seams. The increase in the percentage of the State's total bituminous coal output cut by machinery has been considerably slower than in either West Virginia, Ohio, or Kentucky. It is possible that further mechanization of Pennsylvania's mining operations might add appreciably to the State's output, in competition with other districts, but any increase of employment would be unlikely, unless the National demand for bituminous coal should experience a considerable future growth.

If it were possible, by an improvement in mining methods, to decrease the labor costs per ton in the production of anthracite and through such a reduction passed on to the consumer to broaden the anthracite market, the probabilities of increased employment in the anthracite area are somewhat more favorable, since here the limiting factor in demand is competition with another type of fuel in whose production labor cost is a relatively minor factor. As stated above, however, it is not the relative cost of the heat units from anthracite as compared to those from fuel oil which has of late years shifted consumer demand. The future of anthracite as a domestic fuel, now and for many years to come, will depend upon the success with which the industry meets the problems of comparative convenience and ease of handling of its fuel in the cellars and furnaces of millions of American homes.

METALS

In 1916, 35.68% of all Pennsylvania industrial employment was in the metals industries. In 1940 these industries employed 35.5% of all Pennsylvania workers, an entirely insignificant percentage change in a quarter of a century. No other major classification of industry provides jobs for so many Pennsylvania workers. A study of the index of employment in the metals industries, as shown in the chart reveals the fact that this class of manufacture has been subject to very wide fluctuations in employment over the course of the past quarter of a century, rising to its highest point, not in years of great financial and consumer prosperity like 1929, but only in years of war. During the seven years from 1922 to 1929 total employment in the metals industries suffered a decline climaxed by the great depression of 1930-'36. In the production of primary metals -- that is in the output of our steel and iron furnaces, smelters, and rolling mills, this decline was most marked both in the depression year of 1921 and in that of 1932. Again, in the depression year of 1938, it was in the production of the primary metals that the employment index fell lowest of all the industries in this group. Machine production, while subject to large fluctuations in employment from year to year, has been on the whole a stabilizing influence in this group, though the trends are similar to those of the primary metals. It is in the non-ferrous metals, however, that a considerable expansion in employment is seen over the past quarter century. A large part of this growth has been due to increased production in the various branches of the light metals industries, to the dominance of the State's zinc industry and to an increased production of brass and brass products. This expansion occurred against the general trend even during the post-war depression of 1921 and is an excellent illustration of the possibility of utilizing industrial developments made necessary by war in providing peace-time employment at the close of war.

INDICES OF PENNSYLVANIA EMPLOYMENT
METALS AND METAL PRODUCTS



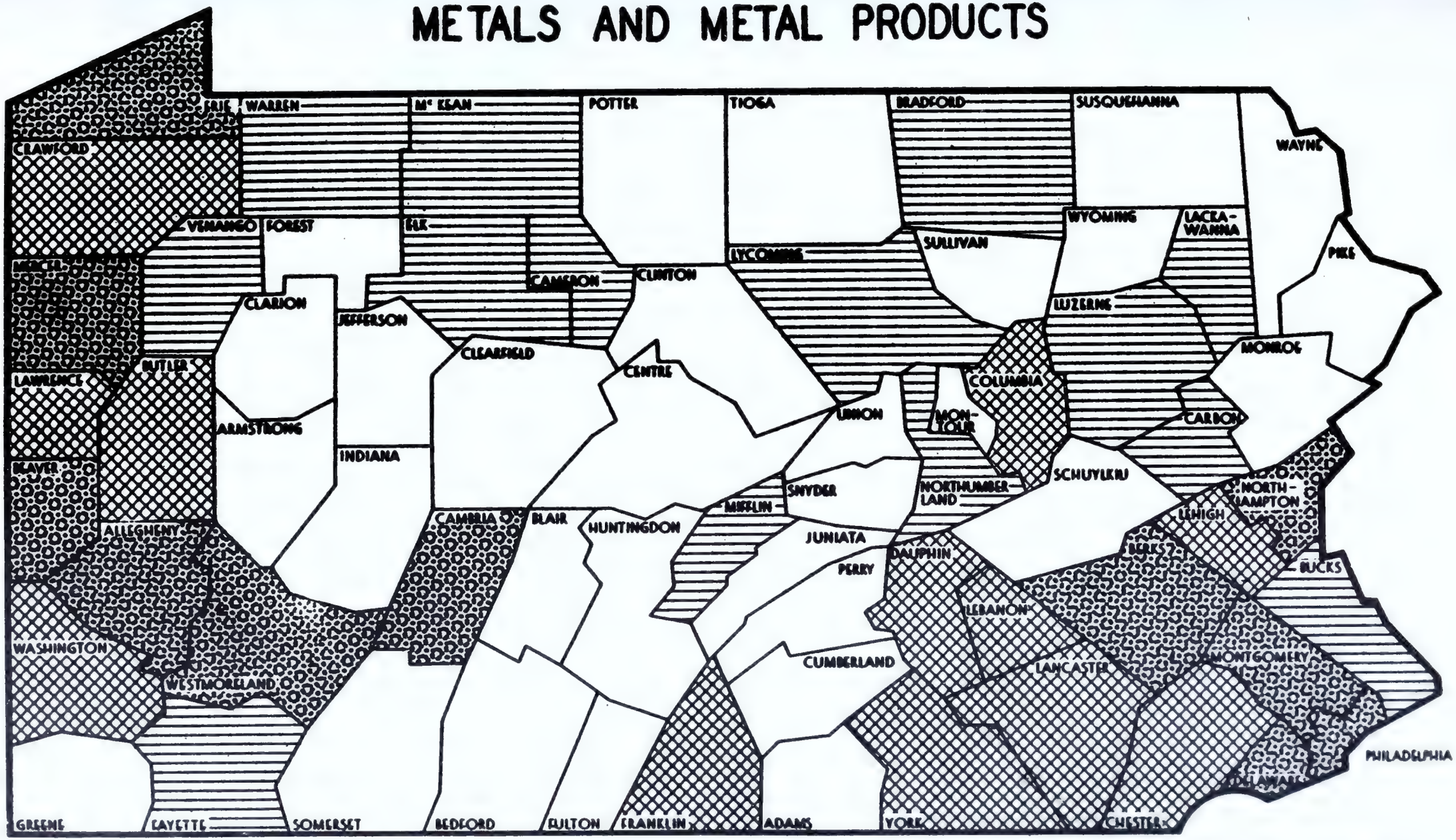
Many factors have contributed to the fluctuations in the metals group. In 1919 there was a declining demand for raw metal and a declining employment during the period of reconversion to the manufacture of peace-time products. The recovery in 1920 was short-lived. It was followed by the somewhat drastic postwar depression of 1921 during which employment in the metals industries fell from 570,000 to 367,000 in a single year. Recovery to 1920 levels of employment in all but the non-ferrous metals groups required a period of twenty years. Despite a great increase in population and the growth of industry the effect of technological improvement was so great in the primary ferrous metals that employment in 1940 was lower than in the middle '20s, though the machine industry was operating at a level of employment which had been equaled only once before in the State's history.

As in the case of many other industrial groups analyzed in this chapter, it is clear that future employment opportunities in the metals industries have come to depend more and more, during the 20th Century, not so much on the primary industrial products as on their secondary derivatives. The production and distribution of consumer's goods is the ultimate aim of all industry, but in this process the primary metals are being used with increased economy and produced in normal times with greater mechanical efficiency. Variety is the keynote of the world which has been created on the foundation of iron, coal, and steel and the testimony is unmistakable that only through the acceptance of this demand for variety and the diversification of industry to meet that consumer demand can any assurance of stable employment conditions be looked for in the future.

Pennsylvania is particularly fortunate in the opportunity to employ its very large production of ferrous and non-ferrous metals in the manufacture of consumer goods with every advantage of markets, transportation, and raw materials. As a leader in the production of the stainless steels and as the home of the aluminum industry in America, its manufacturers have available, and in unlimited quantity,

1940-41

METALS AND METAL PRODUCTS



MORE THAN 15,000 EMPLOYEES

5,000 TO 15,000 EMPLOYEES

1,000 TO 5,000 EMPLOYEES

LESS THAN 1,000 EMPLOYEES

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

those metals and alloys from which a large part of the consumer goods of the next generation is likely to be manufactured. Adapting these now abundant and highly developed alloys to almost every line of production affords the most outstanding opportunity now available to the great metal producing centers of our Commonwealth for continued postwar prosperity.*

* See the "Light Metals and the Stainless Steels", a publication of the State Planning Board of the Department of Commerce.

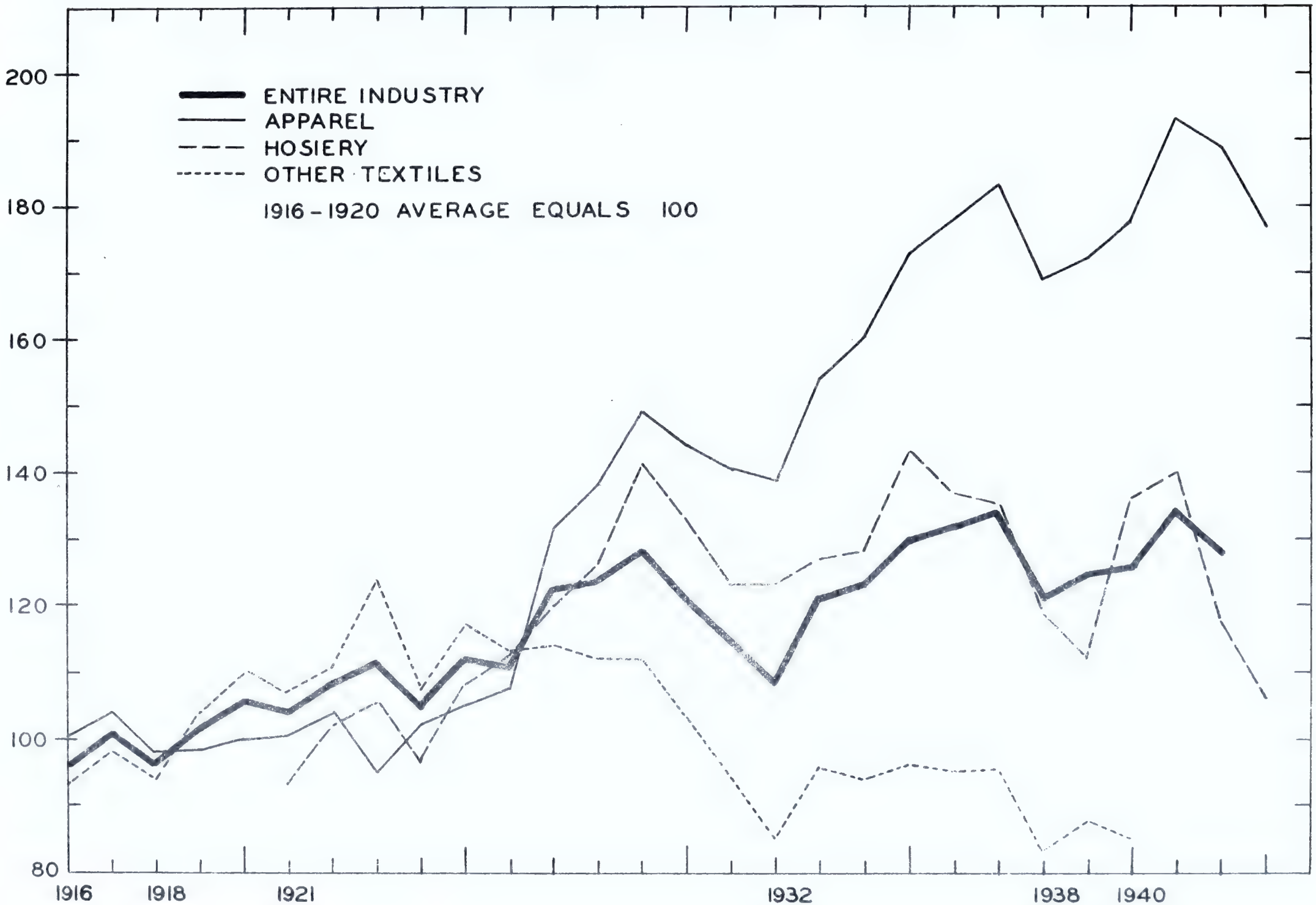
TEXTILES

Employment in the Textile Industries in Pennsylvania, as recorded in the accompanying chart, has exhibited an unusual stability over the past twenty-seven years. despite what was at one time regarded as a serious menace -- the transfer of many of our textile industries to low wage areas in the south. There is reported in this chart a very considerable rise in employment in the manufacture of apparel, in which industry the employment index in 1941 stood at 192.9 as compared with an average of 100 in the period 1916 to 1920. Even in the depths of the great depression employment in Pennsylvania's apparel industries was less than 10% below that in 1929. From that low point the rise was rapid and gratifying to 183 in 1937 and after a brief setback in the depression of 1938 to a second peak in 1941.

Employment in the textile industries experiences no stimulation in a period of war as may be seen between 1916 and 1918 and between 1941 and 1943, although those industries contribute heavily of their resources to the manufacture of military uniforms, parachutes, and other essential equipment. In the manufacture of women's clothing, in the knitting of silk and rayon hosiery, in the weaving of broadloom silks and in the manufacture of broadloom carpets, Pennsylvania stands first in the United States. While the hosiery industry has, as everyone knows, experienced a serious shortage of raw materials as a consequence of war, the employment record is one of a steady and encouraging growth with no very serious setbacks in the last quarter of a century, a growth more rapid, in fact, than that of employment in this branch of industry in the Nation as a whole.

Concentration of the textile industries in the northeast of Pennsylvania has in part been due to the dominance in that section for many generations of the mining of anthracite coal, an almost exclusively masculine occupation. Since the primary industry of the anthracite county afforded no employment for women, there existed a large surplus of female labor in the entire area. This fact in con-

INDICES OF PENNSYLVANIA EMPLOYMENT
TEXTILES AND TEXTILE PRODUCTS



nection with the early establishment of textile mills in nearby Berks County did much to stimulate the growth of silk throwing and of the spinning and weaving industries in the northeastern counties.

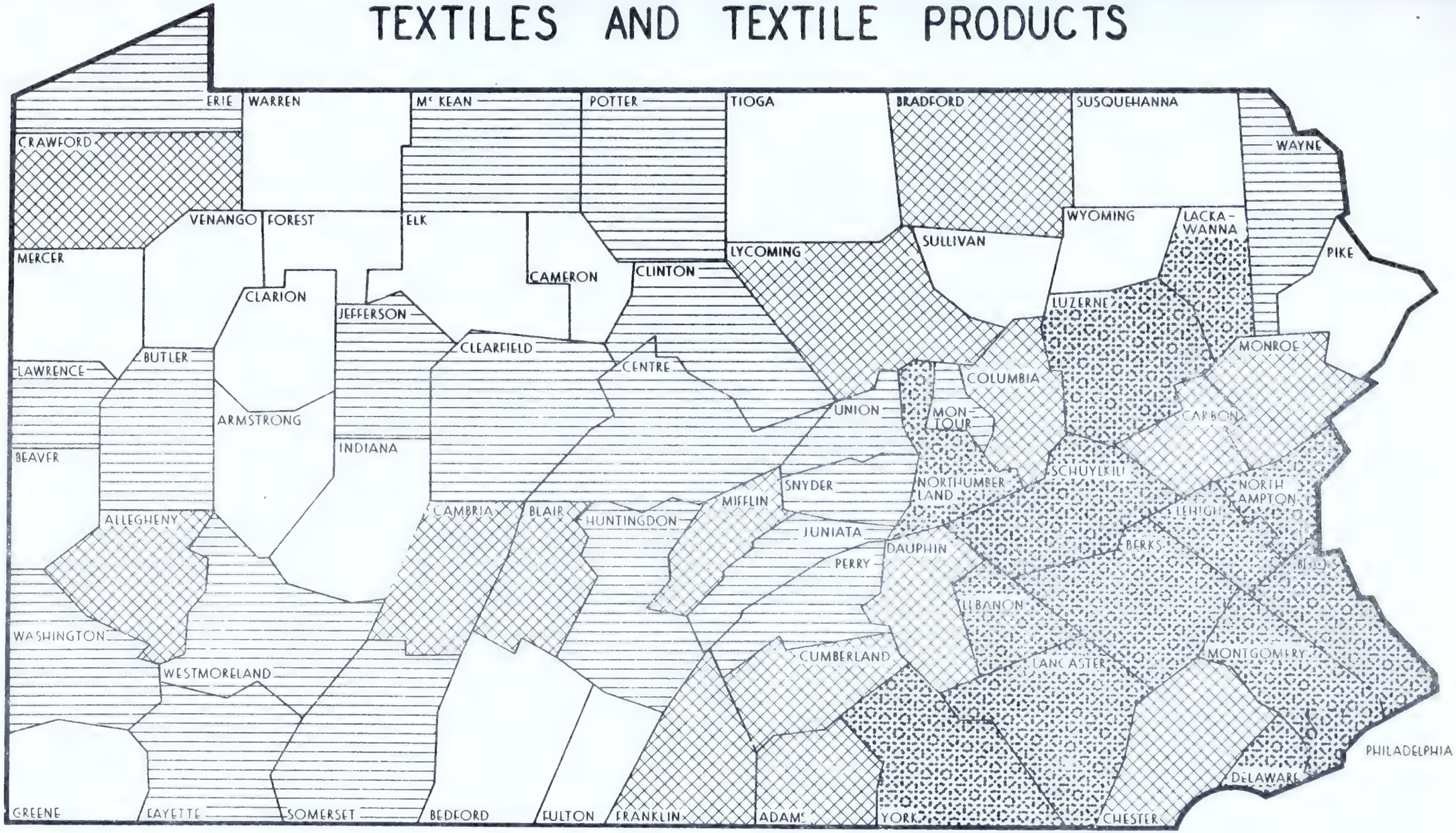
Pennsylvania's National leadership in the manufacture of fine hosiery, of knitted goods and of women's clothing has proved, in the past, to be an important stabilizing influence in our employment picture. This is a class of product for which the demand is unusually steady and one where the growth of a higher standard of living and particularly the rise in the economic independence of women give promise of an increasing future demand.

Reconversion in the various branches of this industry requires the minimum of time and expense, and the fact that of Pennsylvania's 1,770,168 industrial workers nearly 287,000 were employed in the textile industry in 1941 is one of the more favorable factors in the State's immediate postwar prospects.

The compensation per employee in this industry is comparatively low, but in 1941 the value of its products exceeded one billion dollars. The value added by manufacture was nearly $490,000,000 and the total wages and salaries paid out were $307,145,300. It provided a considerable employment in fifty-two counties in the Commonwealth -- the leading textile counties being Philadelphia, Berks, Montgomery, Northampton, Lehigh, Luzerne, Lancaster, Lackawanna, Schuylkill, Delaware, York, Bucks, Northumberland, and Lebanon.

1940-41

TEXTILES AND TEXTILE PRODUCTS



OVER 5,000 EMPLOYEES

1000 TO 5,000 EMPLOYEES

100 TO 1,000 EMPLOYEES

LESS THAN 100 EMPLOYEES

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

FOODS

Expansion of employment in the food industries in Pennsylvania has continued with only minor setbacks in the postwar depression year 1921, in 1932, and in 1938. On a percentage basis the growth in employment in the food industries of the State very considerably exceeded that in the Nation as a whole.

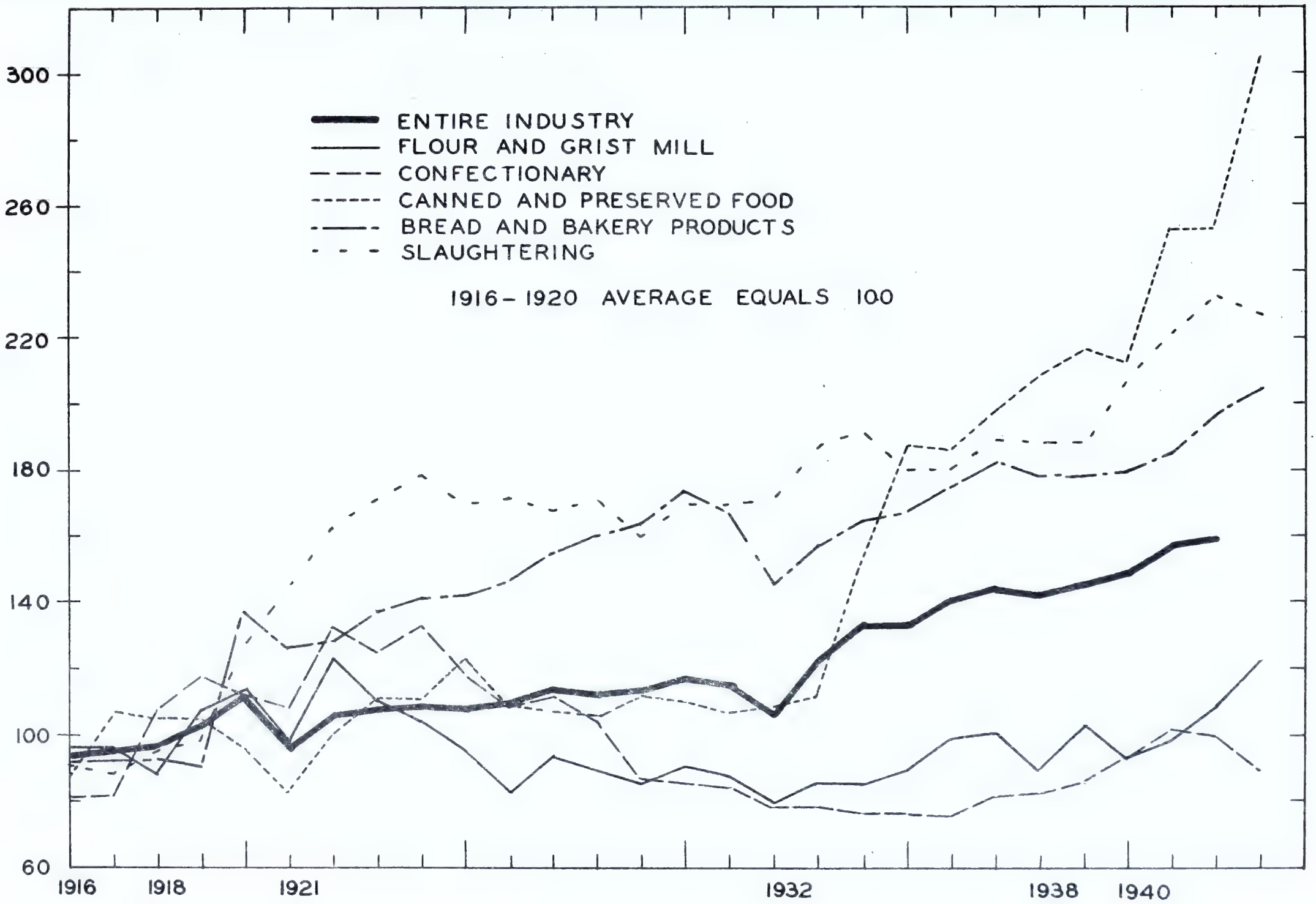
In the preparation of grain products employment has doubled during the past quarter of a century. It has more than doubled in the slaughtering industry. It appears to have stabilized in sugar refining and has multiplied by approximately three times in canning and preserving foods. These facts are shown in the accompanying chart.

The growth of employment in this industry, like that in the textile industries of the State, was an obviously stabilizing influence during the period of the great depression and illustrates, as does the textile chart, the superior stability of those industries which depend upon consumer's daily necessities as compared with those that flourish chiefly in the periods of industrial expansion.

There is no evidence in the Chart of Employment in the Food Industries that Pennsylvania has as yet fully developed the possibilities of expansion in the various forms of food processing made possible by the State's basic agriculture. This fact is emphasized by the distribution map shown in connection with the chart. In each of twenty-seven of our counties, many of which are distinguished by their agricultural products, less than 200 people are employed in the manufacture of foods and food products. Full utilization of the opportunities afforded in the preparation and packing of agricultural products for the market could ensure the continuous upward growth of the State's food products employment curve for years to come.

Many of the Nation's greatest tin plate mills are located in the Commonwealth as well as leading manufacturers of glass containers. Pennsylvania is among the important American producers of many fruit and grain crops. The canning and

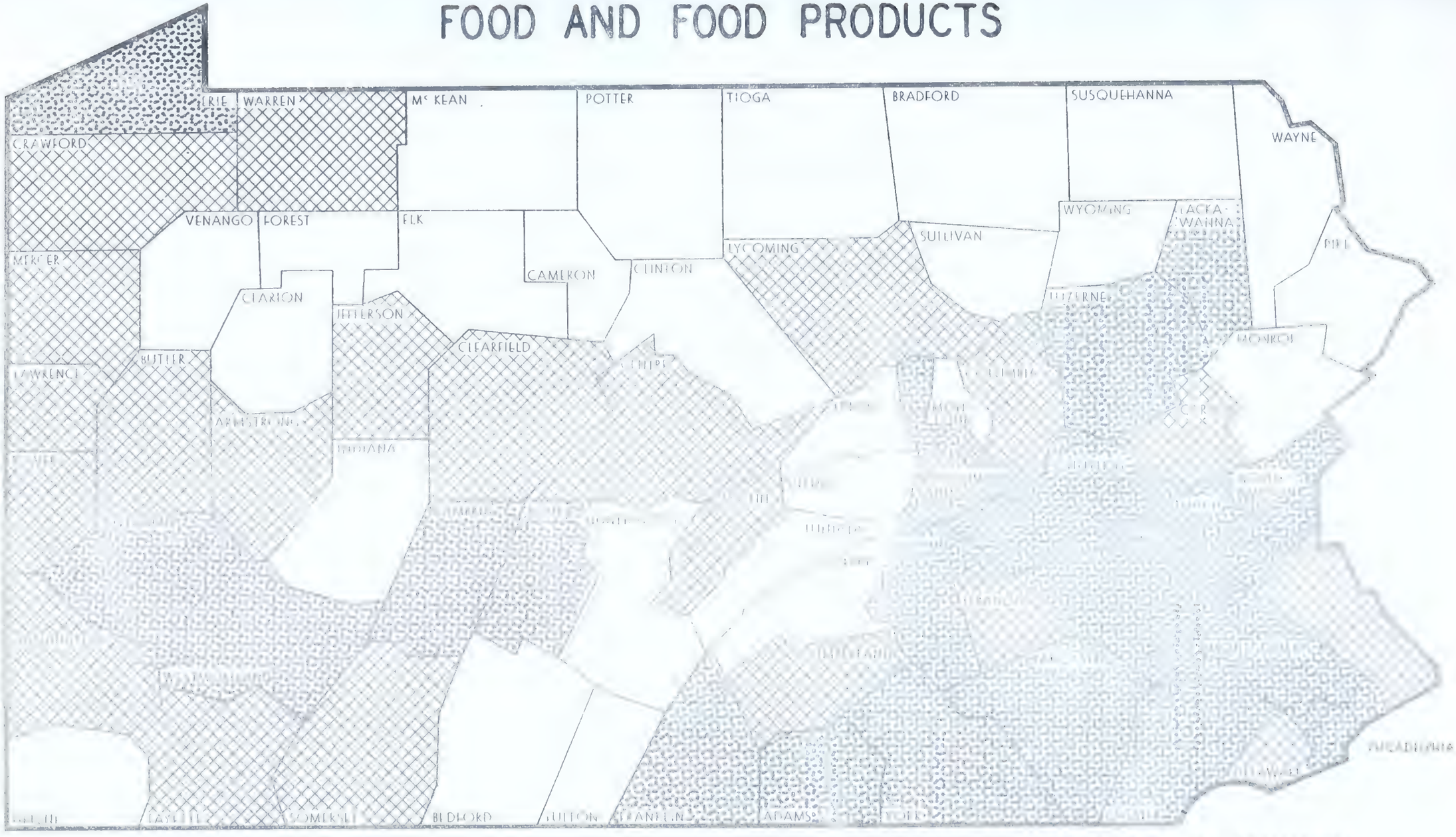
INDICES OF PENNSYLVANIA EMPLOYMENT
FOOD AND FOOD PRODUCTS



packaging of these products and the preparation of feeds for the large dairy herds and poultry flocks of the Commonwealth might well provide whole or part-time employment for a growing number in all of our agricultural counties. There is every evidence that with the increasing employment of women, the dependence on prepared and packaged foods in the average American home is steadily growing. With their close access to many of the largest consumer markets in the world, Pennsylvania farms and country towns afford ideal locations for various types of food packaging industries based on local agriculture.

1940-41

FOOD AND FOOD PRODUCTS



1,000 OR MORE EMPLOYEES

200 TO 1,000 EMPLOYEES

0 TO 200 EMPLOYEES

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

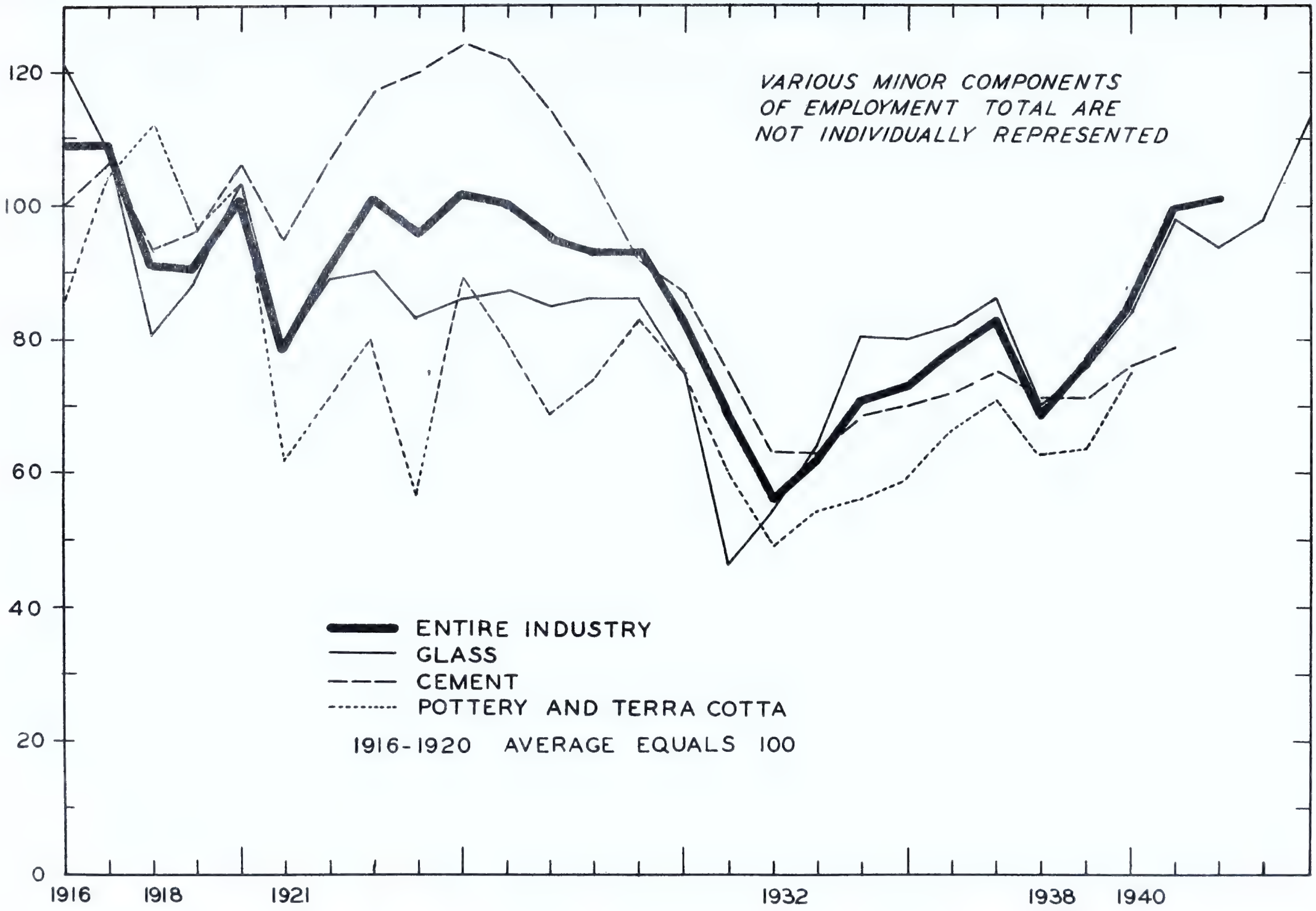
CLAY, GLASS & STONE PRODUCTS

Employment in the Clay, Glass, and Stone Industries in Pennsylvania is now at approximately its level in the period of the First World War, after having experienced a serious decline in the 1932 depression and in the depression of 1938. The component of employment showing the least recovery in this period is the cement industry which, at the end of 1943, stood at a level of 63% as compared to the 1916-1920 average. This is true despite the fact that Pennsylvania is by far the leading State in the Union in the production of cement and is second in the production of lime.

An important factor in the failure of the Cement Industry to provide as large a volume of employment in the past ten years as it did in the period from 1921-'28, when it rose sharply following the First World War, was the long-term decline in the building industry which followed the construction boom in the 1920's. Another factor of importance is undoubtedly the diversion of purchasing power from the construction industries to the automotive industries in the past fifteen years. It must, however, always be remembered that in this field, as in many others, the development of industries in other states must necessarily diminish Pennsylvania's proportion of the National total of production. Since the limestone deposits from which cement may be manufactured are widely distributed in the United States, and the product is one in which transportation costs are considerable, the growth of competition has considerably affected Pennsylvania's employment in this field.

Pennsylvania is the largest producer in the United States of flat glass and of many forms of glass containers. The various branches of the Glass Industry gives employment to some 22,000 workers in twenty-nine counties of the State. The accompanying map, however, illustrates the remarkable concentration of the State's glass production in the area surrounding Pittsburgh where access to excellent glass sands and the availability of natural gas have favored the continuing growth of an

INDICES OF PENNSYLVANIA EMPLOYMENT
CLAY GLASS AND STONE PRODUCTS



industry which was, at one time, largely concentrated at various points along the Atlantic coast. There is no limit to the future expansion of Pennsylvania's glass industries in either the State's power resources or its raw materials. New types of glass products adapted to architectural and decorative uses, and to textiles promise an ever widening use for this inexhaustible material.

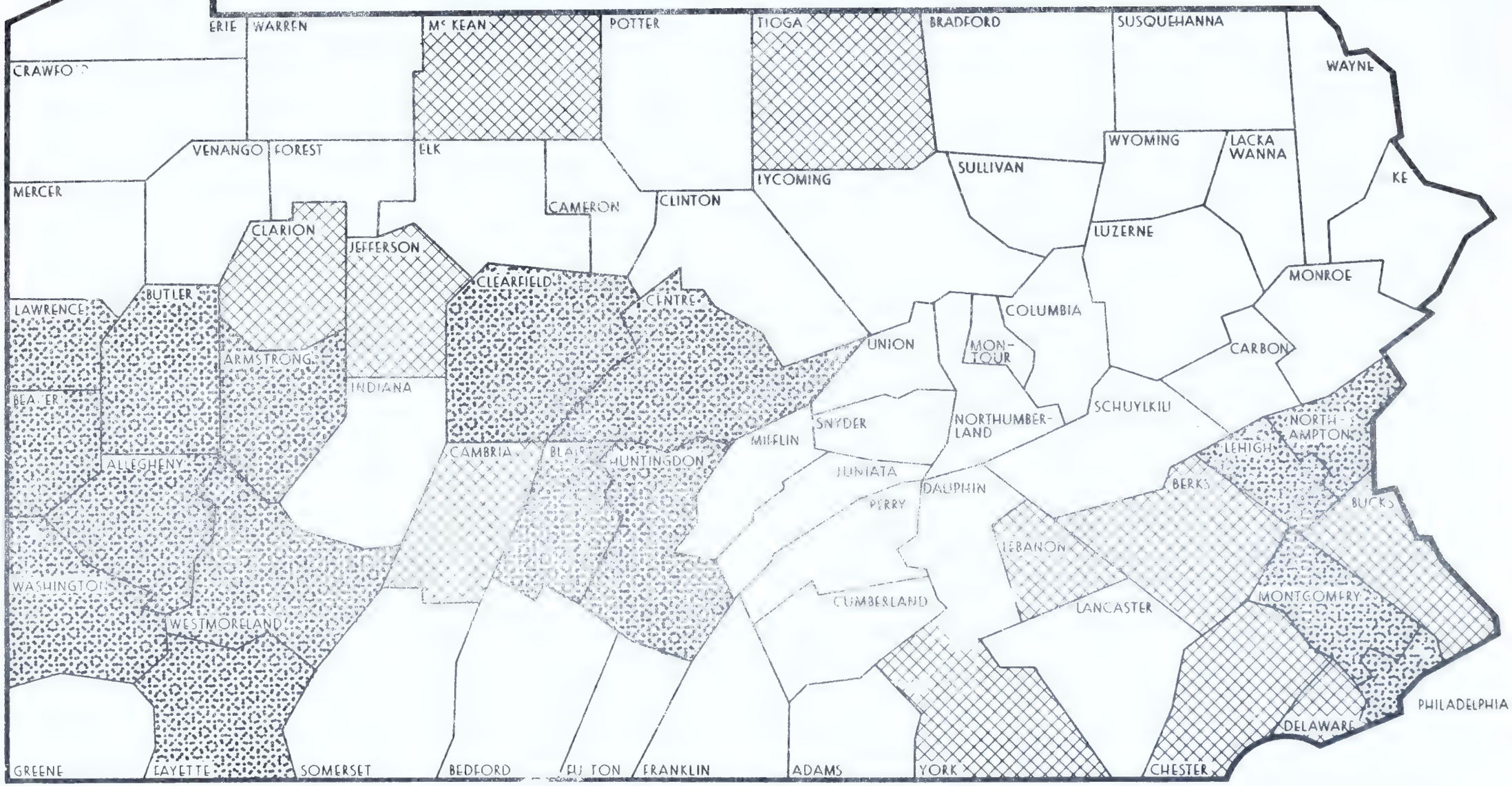
The great center of the Clay and Terra Cotta Industries and of the production of refractory brick and furnace lining is in the four counties in the center of our State - Centre, Clearfield, Huntingdon, and Blair - where abundant sources of various types of clay have stimulated the development of an industry employing thousands of workers. Lehigh and Northampton Counties in the East are the heart of the Cement Industry due to the presence in those two counties of very large deposits of limestone rocks from which a superior grade of Portland and other cements can be manufactured. Lawrence County provides considerable employment in the production of pottery and chinaware, while in Montgomery, Philadelphia, and Beaver Counties employment is diversified among the several branches of glass, clay and limestone production. These industries are dependent to a large extent for their success on local raw materials, but the Commonwealth is particularly rich in its deposits of various types of stone, sand, shale, and clay which might well become centers of thriving local industry in many counties where such industries today provide little employment.* The growing interest in various types of hand made pottery thrown from Pennsylvania's native clays promises the revival of what was once a major industry in the Commonwealth and points to possibilities that have been long neglected.**

* Various publications of the Bureau of Topographic and Geologic Survey of the Department of Internal Affairs contain detailed information as to the State's mineral resources, and the qualities of the rock, clay, and sand deposits of its counties.

** See "Pennsylvania Handicrafts" - a publication of the State Planning Board of the Pennsylvania Department of Commerce.

1940-41

CLAY, GLASS AND STONE PRODUCTS



MORE THAN 1,000 EMPLOYEES

500 TO 1,000 EMPLOYEES

LESS THAN 500 EMPLOYEES

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

PAPER AND PRINTING

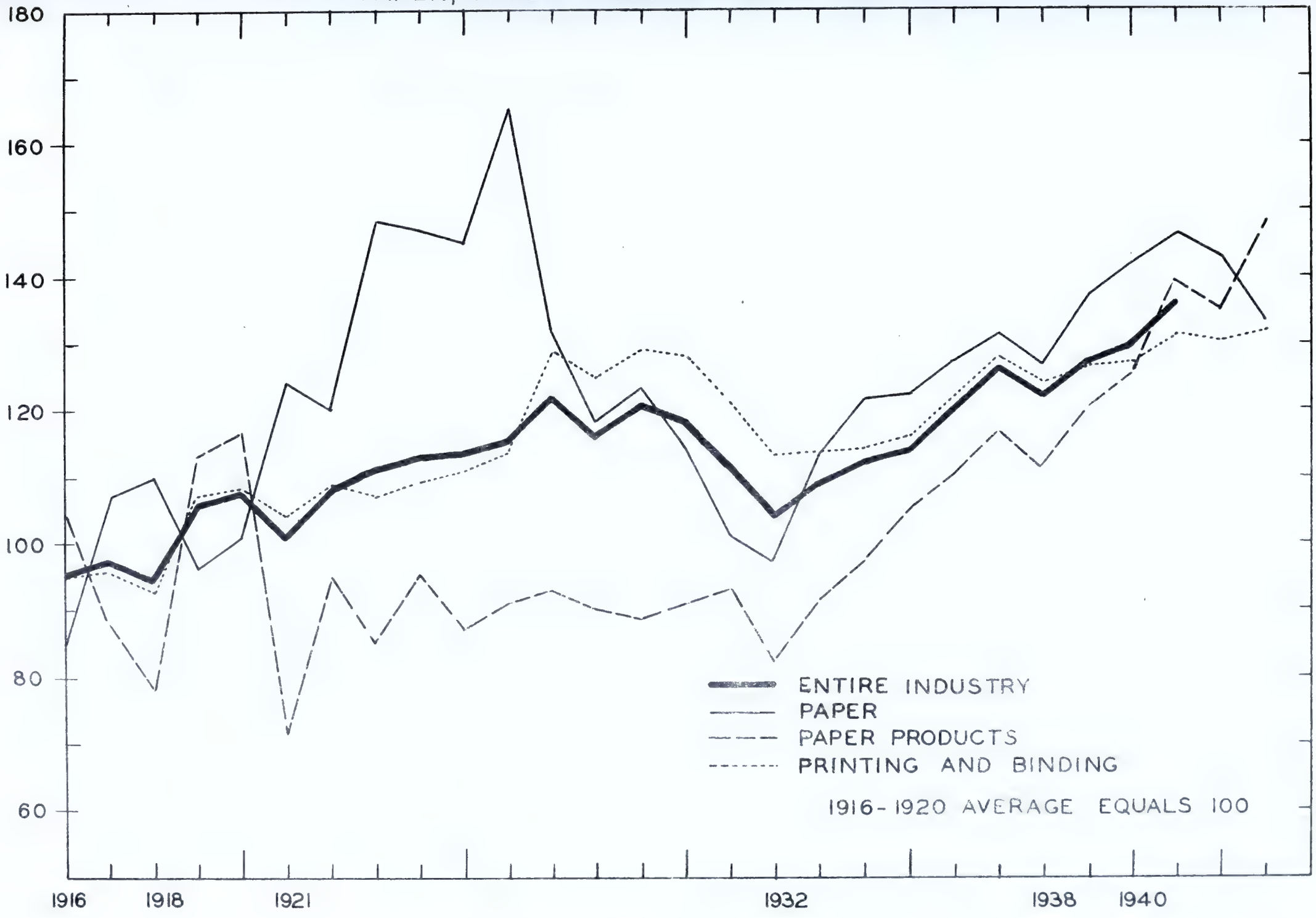
These two not very closely allied industries form a group in which the employment gains have been fairly steady since 1916. In the printing and publishing business employment is somewhat stimulated by war time conditions, but is subject to less drastic declines during periods of industrial depression than is true in many other types of industry.

In Pennsylvania there are several important centers of printing and publishing - Philadelphia, Harrisburg, Lancaster, Scranton, Wilkes Barre, Pittsburgh, and Williamsport. Historically, these cities were early in the development of the printing trades and have continued that dominance in the State for several generations. It is natural that certain branches of this industry should be rather directly dependent on population density in the surrounding areas. This is not, however, true of book publishing, and the long-continued success of certain Pennsylvania periodicals, published in comparatively small cities, has demonstrated that one important phase of publishing is dependent for its prosperity only upon individual enterprise. There seem to be definite possibilities in the postwar years for the expansion and development of substantial publishing enterprises in various Pennsylvania cities which have at one time or another been important in the history of American printing and publishing.

In the paper products industries employment growth has been very considerable in the past ten years and has been stimulated by war-time demand for various types of packaging and containers. Whether this particular branch of the paper industry will experience the decline which occurred in 1921, in the depression following the First World War, will very largely depend upon the success of the industry in adapting its products to peace-time demand and competition. Total employment in all branches of these industries in the last peace-time year was more than 76,000 of which nearly 46,000 were employed in printing, bookbinding, and allied trades.

INDICES OF PENNSYLVANIA EMPLOYMENT

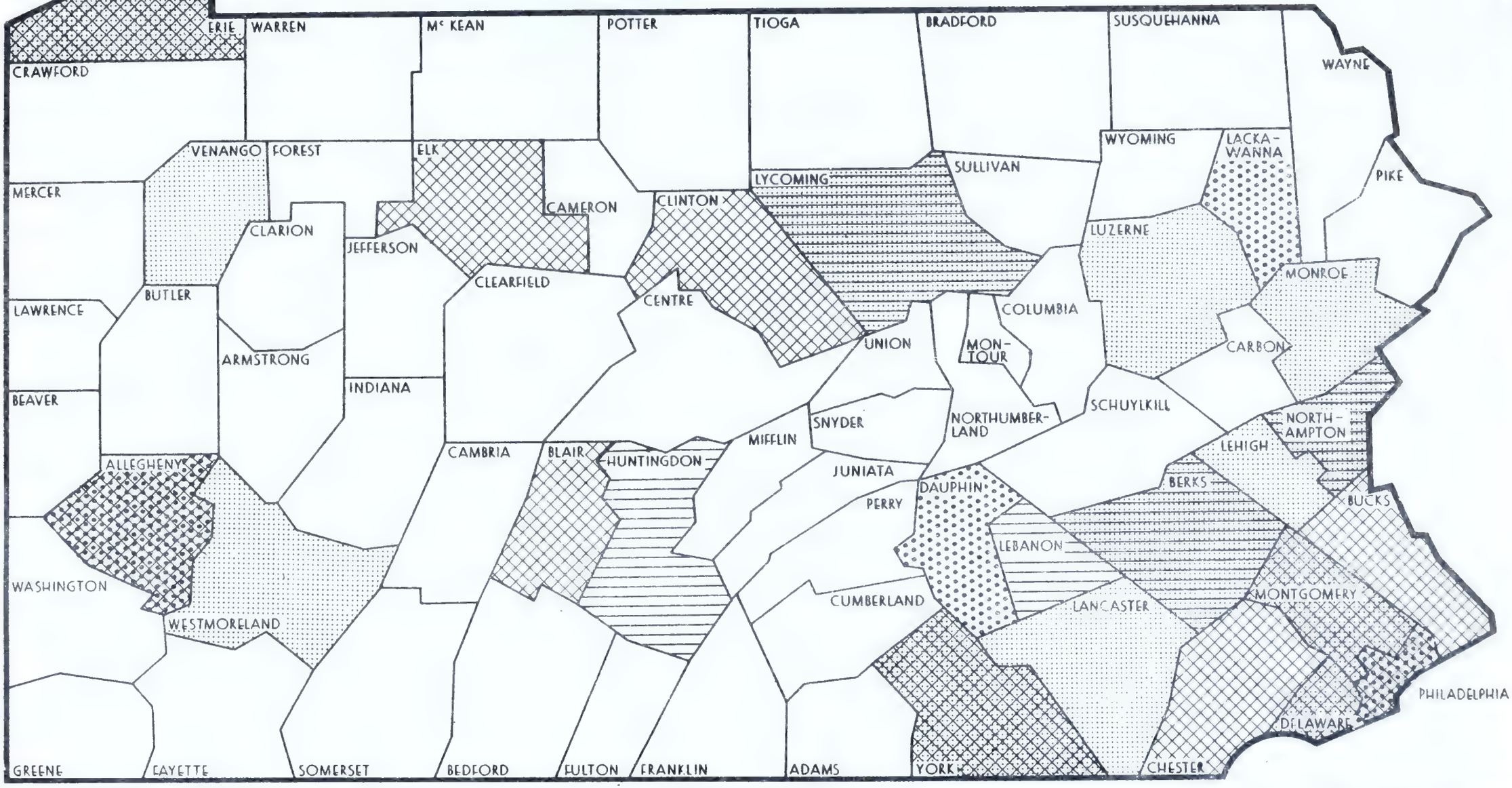
PAPER, PAPER PRODUCTS AND PRINTING



The manufacture of paper and paper products is largely conditioned by available sources of wood pulp and other raw materials, whether through water carriage as in the thriving paper industries of Erie, Chester, and Philadelphia, or through the use of still available supplies of pulp wood in our northern counties where, at one time, forest products afforded the basis of the economy. In Elk, Clinton, and Lycoming Counties, which are important in the forest product industries of the State, and in our southeastern counties - York, Lancaster, Delaware, and Chester - the manufacture of paper and paper products provides substantial employment.

1940-41

PAPER, PAPER PRODUCTS AND PRINTING



PAPER OR PAPER PRODUCTS

OVER 1,000 EMPLOYEES

300 TO 1,000 EMPLOYEES

PRINTING

OVER 1,000 EMPLOYEES

300 TO 1,000 EMPLOYEES

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

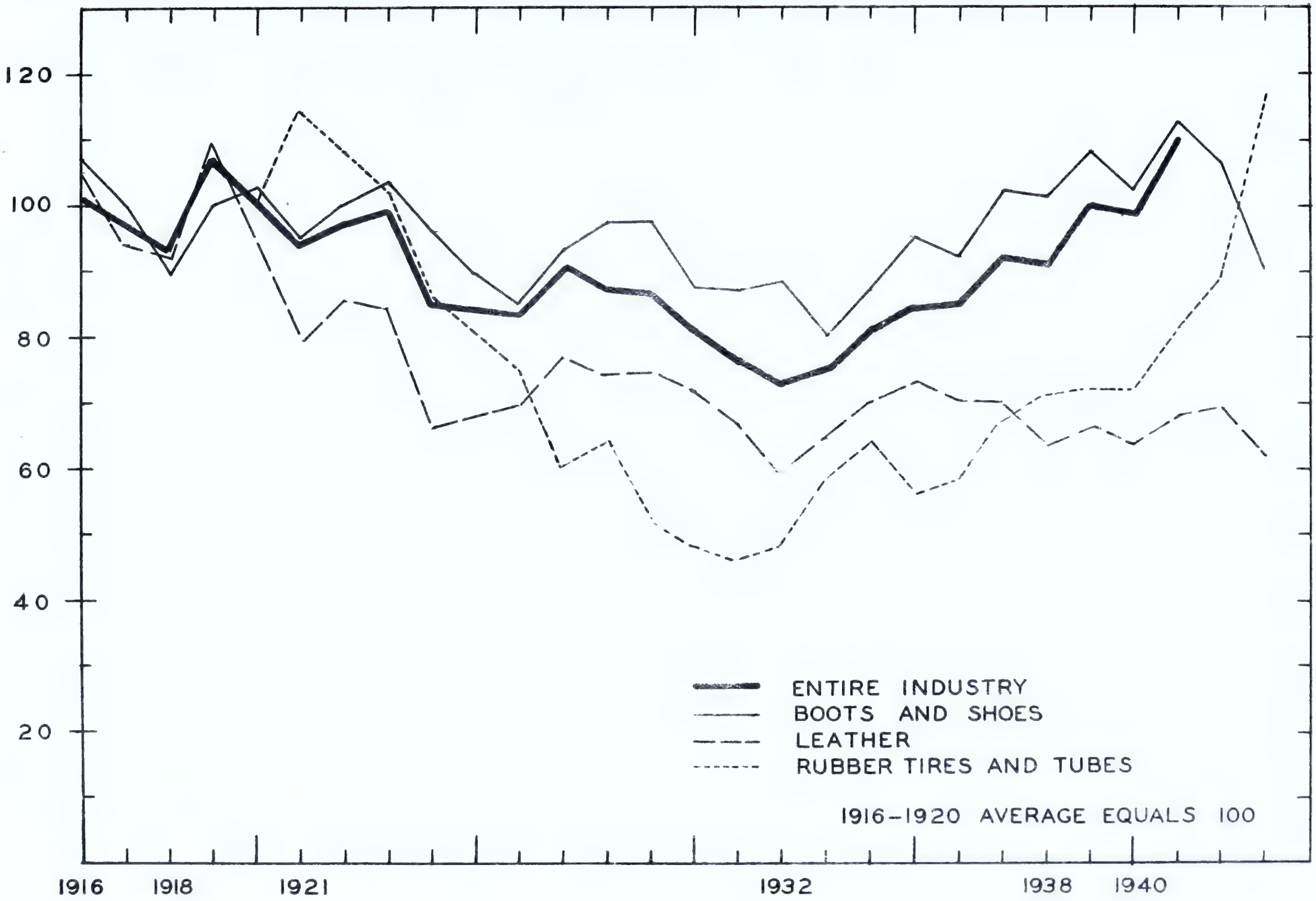
LEATHER AND RUBBER

In 1941, 41,000 Pennsylvania workers were employed in the leather and rubber industries. This represented a very minor advance over the 1920 average, all of which increase was due to the rise of employment in the manufacture of boots and shoes.

In the interval between the First and Second World Wars in which the use of the automobile became universal and the manufacture of rubber tires multiplied many fold, Pennsylvania rather lost than gained employment in this important branch of industry. This must be recorded as one of our lost opportunities in the period under discussion. During the past three years, however, despite the handicaps under which the industry has operated since the outbreak of war, employment in this branch of manufacture stands now at its highest recorded level. This fact promises a substantial increase in the State's share of the tire and rubber business in the postwar years. The State ranks fourth in the value of its rubber tires and inner tubes and fourth in employment in the industry, being led only by Ohio, California, and Michigan. It is third in employment in the manufacture of inner tubes for passenger cars, trucks, and buses.

One matter which may greatly affect the future of this industry in the State will be the extent to which natural rubber is resumed as a basic material for tires in the postwar years. The advantages of the port of Philadelphia as an entry point for supplies of crude rubber from Latin America, or from the far East, might prove an important factor in stimulating the economical manufacture of natural rubber products in Pennsylvania. On the other hand, Pennsylvania has already one synthetic rubber plant in the Commonwealth and provides an abundance of the raw materials and power resources required for the manufacture of this product. The development of industries making use of the various types of synthetic rubber may afford an excellent opportunity for the State to take its proper place in the production of

INDICES OF PENNSYLVANIA EMPLOYMENT
LEATHER, RUBBER AND THEIR PRODUCTS



this important class of consumer goods.

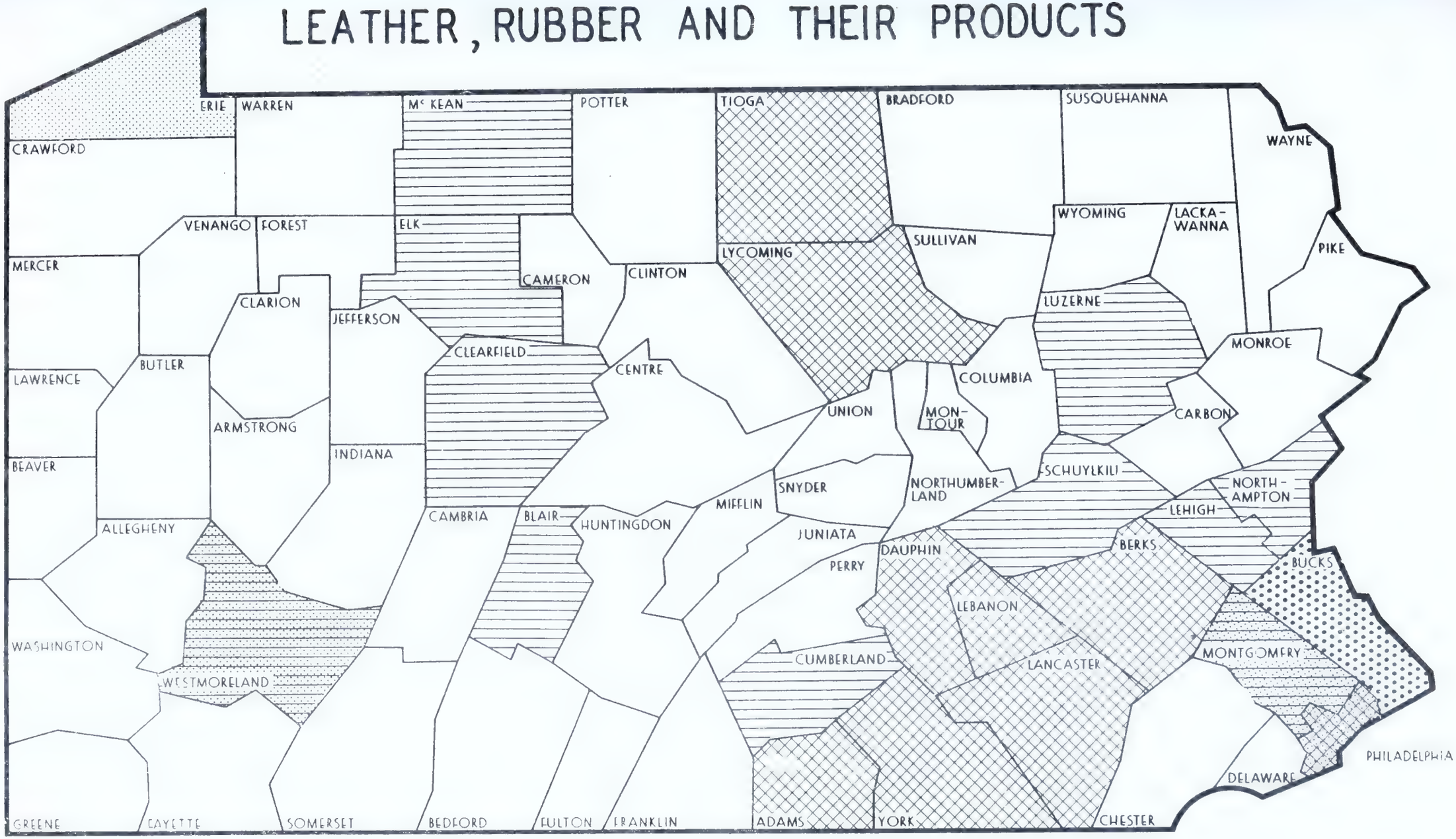
In the manufacture of leather Pennsylvania stands second in employment in the United States, being led only by Massachusetts. The general trend of our employment in this industry has not been upward since 1920, though Pennsylvania was the pioneer State in the transformation from bark tanning to chemical tanning when the decline in the supply of native hemlock bark made this change necessary early in the century. Pennsylvania's position in the manufacture of boots and shoes has, however, somewhat improved in the course of the past twenty-five years, though it would not be true to say that the improvement of employment in the industry has kept pace with the increase in population. This is no doubt due, in a considerable degree, to technological improvements in shoe manufacture which have greatly increased the output per man hour. The State stands fourth in employment in the manufacture of leather luggage, suitcases, trunks, and brief cases, and third in employment in the manufacture of women's pocketbooks and hand bags.

The accompanying map shows a considerable concentration of the leather and rubber industries in the southeastern counties of the State, the shoe industry being largely confined to seven adjacent counties while Tioga County leads in the sole leather industry and Lycoming County provides normal employment for some 1500 in the manufacture of industrial leather goods. A large number of counties in Pennsylvania, as the map reveals, have little or no participation in any of the branches of these two industries, both of which represent products in constant demand and in one of which Pennsylvania was for many years the leading producer of raw materials in the United States and still holds second place.

Though Pennsylvania's shoe production was in recent prewar years approximately 22,000,000 pairs, this output does not, by a very large margin, equal the State's consumption of leather footwear. Since the State is second in our Nation in the currying and tanning of leather and first in the production of sole leather, the production of shoes in the Commonwealth offers an obvious opportunity to manufacturers

1940-41

LEATHER, RUBBER AND THEIR PRODUCTS



LEATHER AND SHOES

OVER 1,000 EMPLOYEES

OVER 300 EMPLOYEES

RUBBER

OVER 1,000 EMPLOYEES

OVER 300 EMPLOYEES

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

desirous of taking advantage of the fact that raw materials and markets, cheap power, and skilled labor for the production of shoes are all available within the Commonwealth. The central location of Pennsylvania to the great consumer markets of the East, the advantage of a great seaport whose trade is largely with the Latin American countires from which our imported hides are procured, and the presence within the State of some of the largest tanneries in the East, all offer an assurance of abundant opportunity for manufacture and sale.

TOBACCO

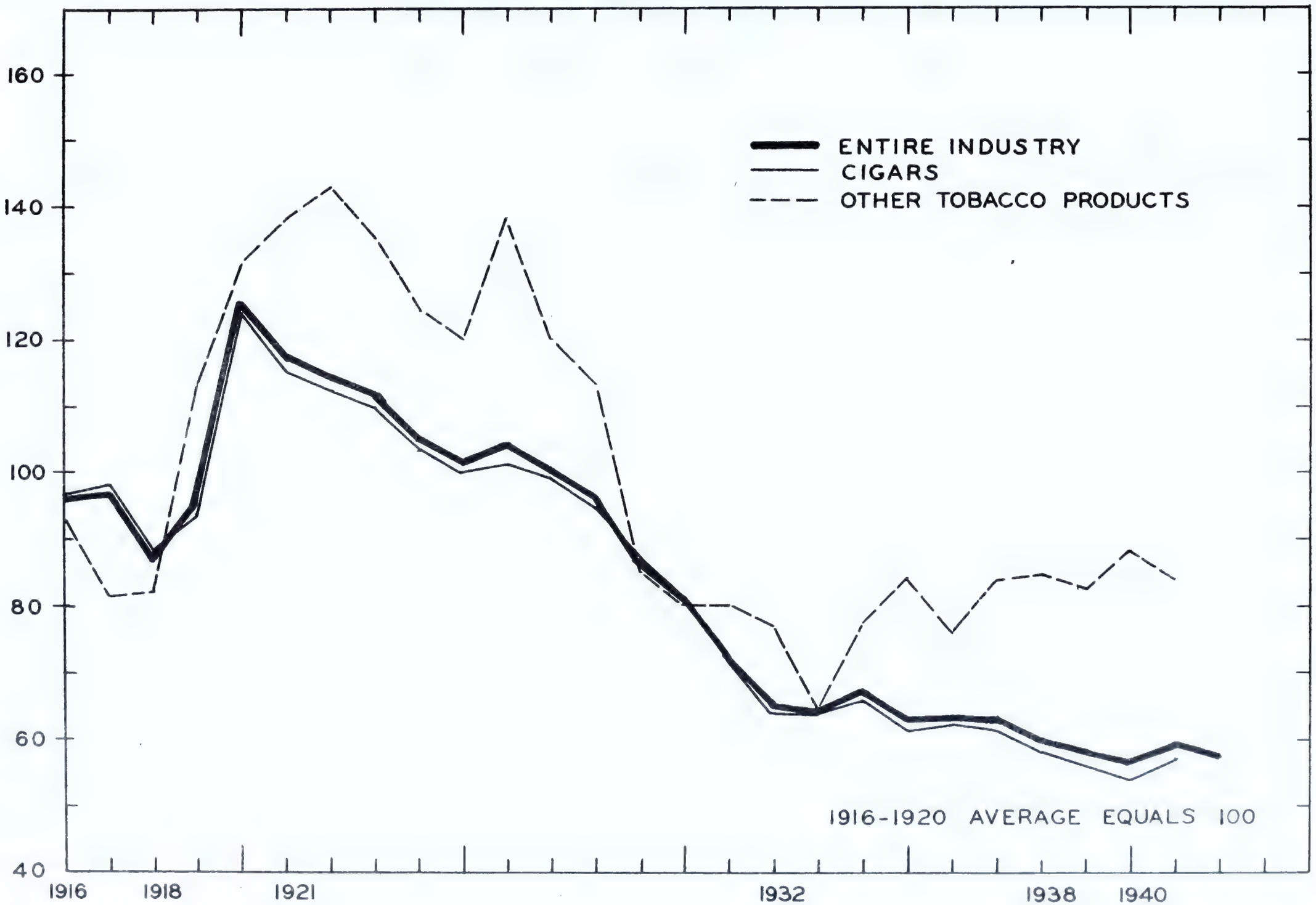
Employment in the tobacco industries in Pennsylvania, declining sharply from 1920 to 1940, almost exactly follows the National pattern. This curve is the clearest evidence available in our industrial picture of the effect on employment in a single type of industry of technical improvements in methods of manufacture. Improvements made during the past twenty-five years in cigarette and cigar making machinery and in the automatic packaging of all types of tobacco products resulted in a decline of 50% in employment, while the consumption of tobacco products has steadily risen. There is some evidence in the accompanying record that the mechanization of the tobacco industry is completed so far as Pennsylvania is concerne and that further rise or fall in employment will be influenced more largely by the level of demand than by technological changes.

In the State's cigar industry, the largest source of employment in this classification, the number of employees reached its maximum of 38,847 in 1920 and gradually declined to 16,848 in 1940. Meanwhile the production per employee had more than doubled from 57,000 cigars a year in 1920 to 116,000 in 1940 and 123,000 in 1941, but except under the influence of war-time demand the total volume produced had changed little between 1920 and 1941. Under such conditions of demand and technological improvement a decline in employment in the industry was inevitable.

Pennsylvania is not only the leading producer of cigars in the United States, it is also the leading producer in the entire world. The value of its cigar production is more than twice that of any other State and its employment in the industry greatly exceeds that of its nearest rival. The industry is, therefore, important in the State's economy but is one which has not, in recent years, shown that growth in the Nation as a whole which has been exhibited by the cigarette industry, a completely mechanized branch of manufacture. Despite the great disparity in the value of production in these two more or less rival branches of tobacco

INDICES OF PENNSYLVANIA EMPLOYMENT

TOBACCO PRODUCTS



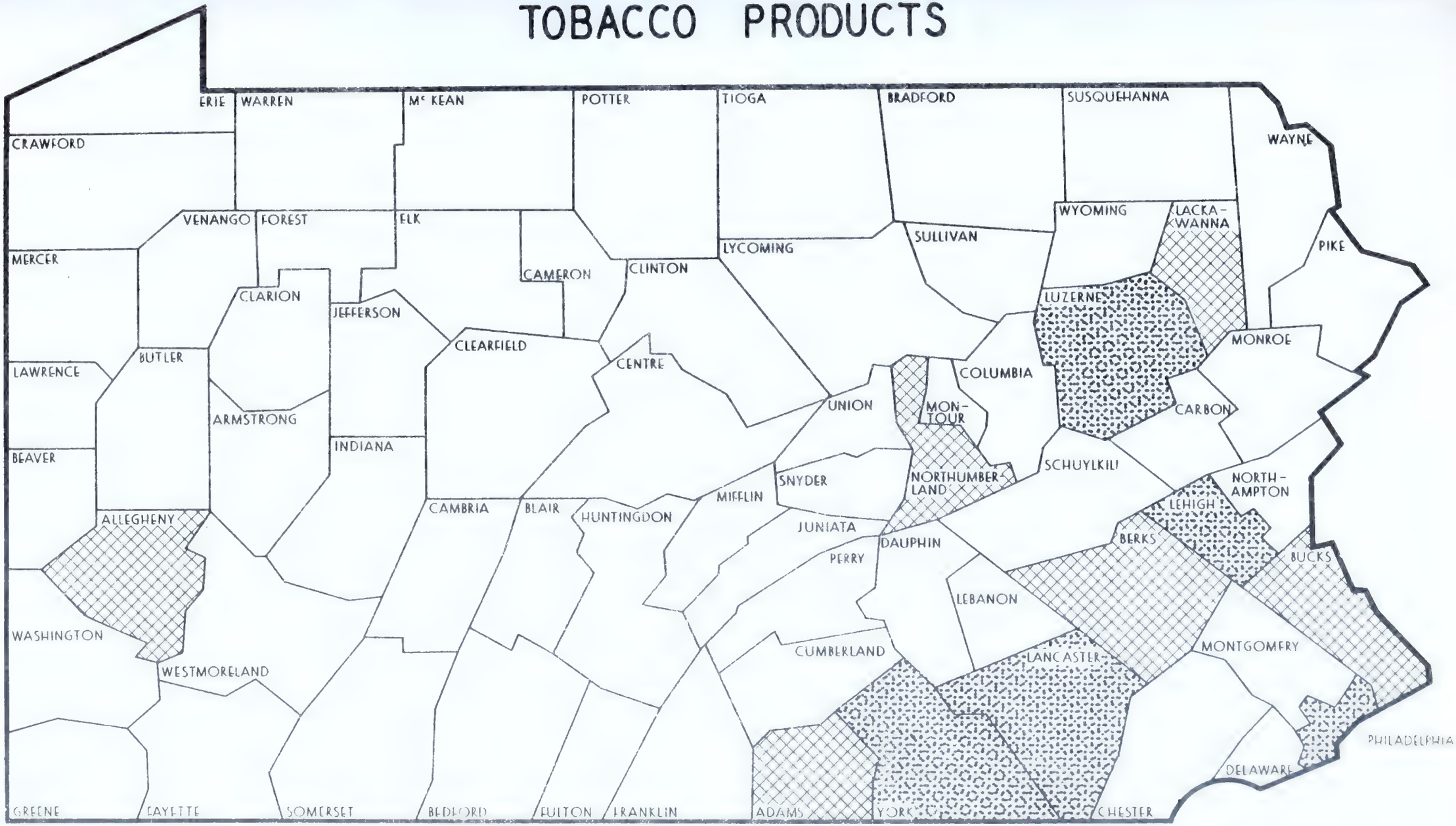
manufacture (cigarettes produced in 1939 being valued at more than $940,000,000, while cigars produced in the United States were valued at nearly $160,000,000, of which Pennsylvania produced more than one-third) employment in the cigar industry was nearly twice that in the manufacture of cigarettes.

Pennsylvania's cigar making industry has been greatly stimulated by the fact that the State is also America's largest producer of cigar leaf tobacco. The agricultural and industrial branches of tobacco manufacturing in the Commonwealth are, threrfore, closely connected.

There is no feasible means of predicting whether present tendencies in the industry will continue, but it is certain that advertising and publicity pressure in favor of cigarette smoking is much more persistent than in the rival field, and it is likely that such pressures will continue. Energetic efforts by the State's cigar makers to increase the popularity of their product would seem necessary if they are to meet this growing competition.

1940-41

TOBACCO PRODUCTS



1,000 OR MORE EMPLOYEES

100 TO 1,000 EMPLOYEES

0 TO 100 EMPLOYEES

PENNA. DEPT OF COMMERCE
STATE PLANNING BOARD

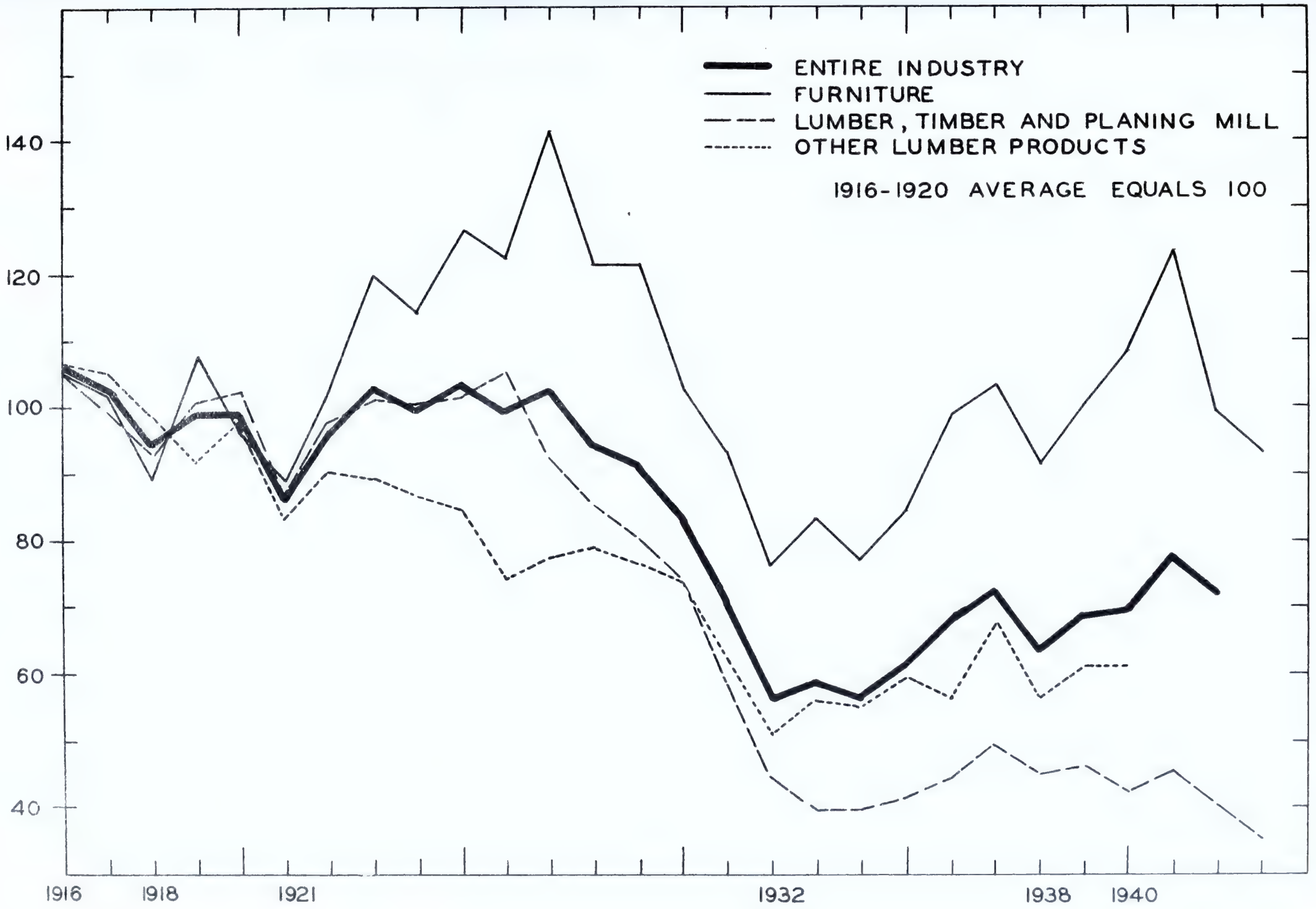
WOOD AND WOODWORKING

Employment in the wood and woodworking industries, including lumber and timber production, exhibited a considerable decline over the past quarter century, although some recovery has been made since the depression year lows of 1932 to 1934. This decline parallels the National experience of employment in these lines, although Pennsylvania's recovery since '32 has not been so rapid as in the Nation as a whole. An analysis of the various types of employment in this general classification as shown in the accompanying chart reveals the fact that in Pennsylvania employment in the manufacture of furniture has shown a healthy recovery from the depression low and did not at any time exhibit so marked a decline as was felt in the other branches of this industry. Even in 1932 Pennsylvania employment in the furniture trades, though exhibiting a considerable loss from its peak year, 1927, held up better than was true in almost every other industrial line.

It is in the lumber and timber producing branches of the wood industries that Pennsylvania's employment has shown a marked decline and a failure to make a healthy recovery since 1932. That this is due to the depletion of the State's timber resources seems clearly evident from the fact that this decline continued steadily through the rising consumer goods markets of the late twenties, and that it was resumed again in the period following 1937 after a brief recovery from the depression low.

It is evident that in furniture manufacturing and in other branches of the woodworking trades employment is on the increase in the Commonwealth but that all the lumber and wood producing industries have suffered a long and serious decline. The great original forest resources of this Commonwealth which gave the State its name are today far from adequate to supply our own needs for raw materials. Since even the great building boom of the 1920s failed to stimulate employment in the timber industry of Pennsylvania, it must not be expected that any great improvement in primary wood production can occur in the Commonwealth without the

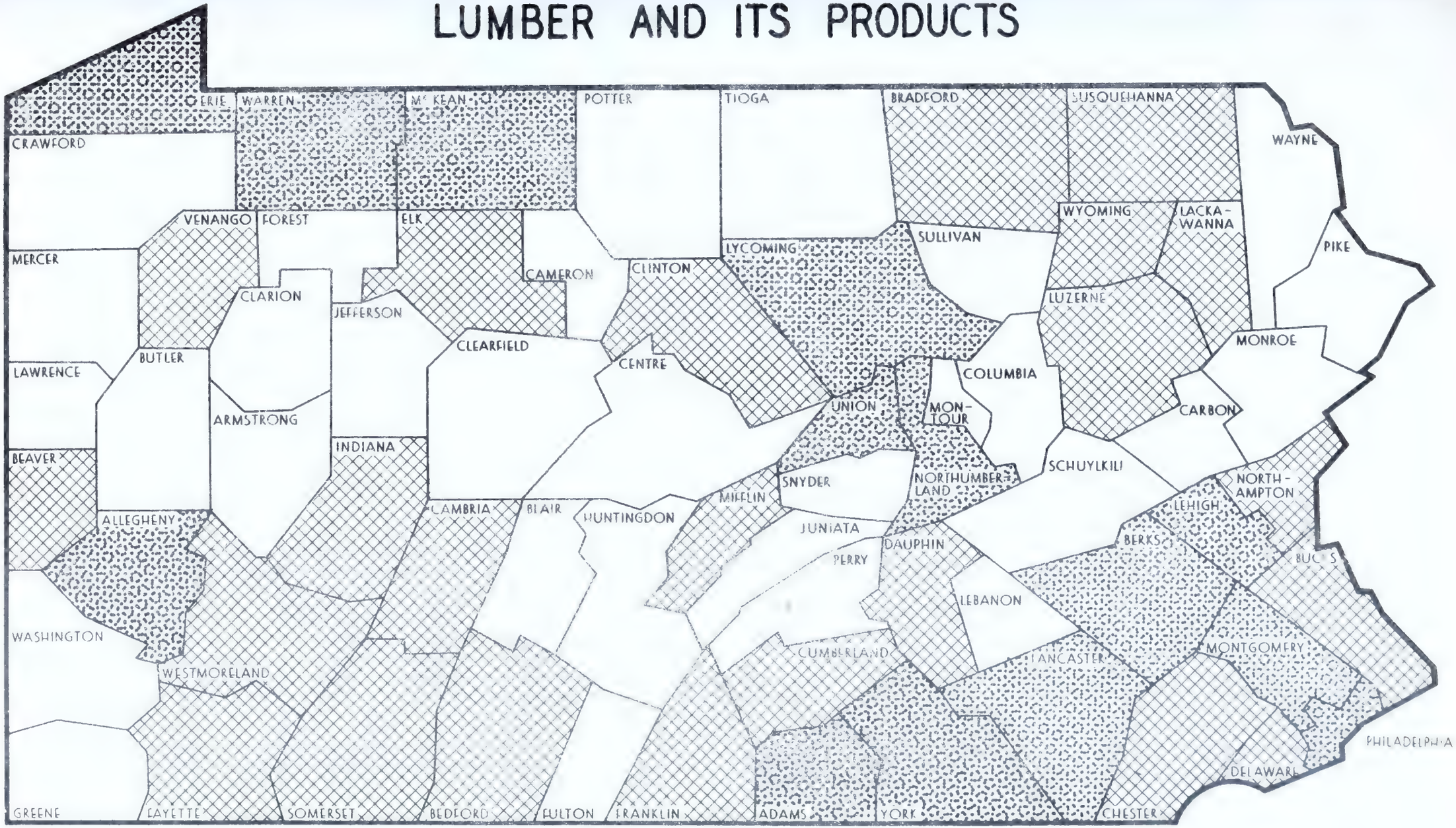
INDICES OF PENNSYLVANIA EMPLOYMENT
LUMBER AND ITS PRODUCTS



adoption of adequate measures, by all owners of timber land, to increase the State's annual crop of saw logs through reforestation and the scientific management on a sustained-yield basis of our formerly great areas of productive forest.

1940-41

LUMBER AND ITS PRODUCTS



OVER 500 EMPLOYEES

100 TO 500 EMPLOYEES

LESS THAN 100 EMPLOYEES

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

CHEMICALS AND ALLIED PRODUCTS

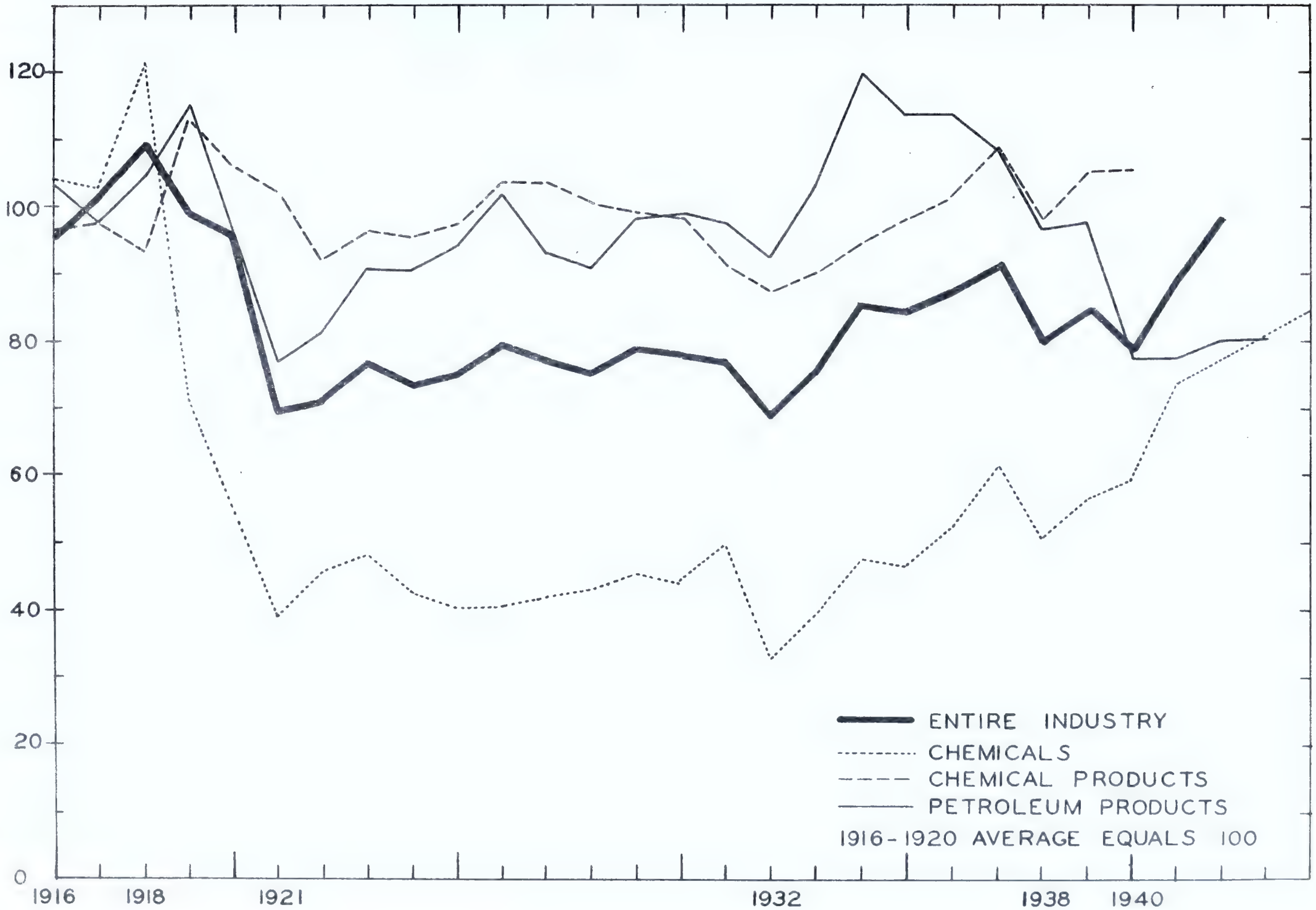
Under this general classification are included the production of petroleum products in oil refineries, of chemicals, powder and explosives, alcohols, acids, and wood distillates, which are grouped under the sub-head, "chemicals", and of a large number of derivative products including cleansing and polishing preparations, printer's ink, matches, paints and varnishes, patent medicines and compounds, and soaps and toilet preparations, all of which are grouped as chemical products.

Petroleum refining is one of the important industries of Pennsylvania and the State is exceeded only by California and Texas in the employment and wages afforded by that industry. The decline in employment recorded in our chart parallels that in the Nation as a whole and is a consequence of the greatly improved efficiency of the new methods of production developed in the past ten years.

In the production of chemicals (not including petroleum) employment suffered a drastic decline at the close of the First World War from 22,665 in 1918 to 7,258 in 1921. After that first postwar depression, the industry made small improvement in employment during a period of nearly ten years and in 1932 reached its quarter of a century low with a total employment of only 6,108. The Second World War has again stimulated chemical production, but to the end of 1941 total employment in all branches of the chemical industries in Pennsylvania was still well below the average of the years 1916 to 1920.

Considering the State's leading place in the mining of coal and the production of coke and coal tar, the great importance of its oil refineries, and of the products of its own oil wells, as well as the large number of metallurgical plants in the State, the failure of the Commonwealth to participate fully in the growth of the American chemical industry is one of the least encouraging features in its recent industrial development. It is true that the census classification "chemicals" fails to include the large and important viscose and acetate manufactures of the State

INDICES OF PENNSYLVANIA EMPLOYMENT
CHEMICALS AND ALLIED PRODUCTS



whose products are classified under textiles. There are fields in the chemical industry in which Pennsylvania occupies a dominant position, but it is obvious that great opportunity now exists in the production of industrial and consumer goods from the raw materials which now flow in such abundance from our great petroleum refineries and by-product coke ovens.

In the manufacture of dyestuffs, colors, and pigments the State is fourth in value of production and in employment. In the broad field of drugs and medicine, it stands fifth in the value of its output and third in employment. It is fifth in its manufacture of perfumes, cosmetics, and toilet preparations but in that field provides only one-eighth as much employment as the State of New Jersey and not one-twentieth as much as the State of New York. It is ninth in employment in the manufacture of soap and glycerin, eleventh in employment in the manufacture of fertilizer, and fourth in plastic materials, despite its leadership in the output of many of the basic chemicals from which these products are manufactured.

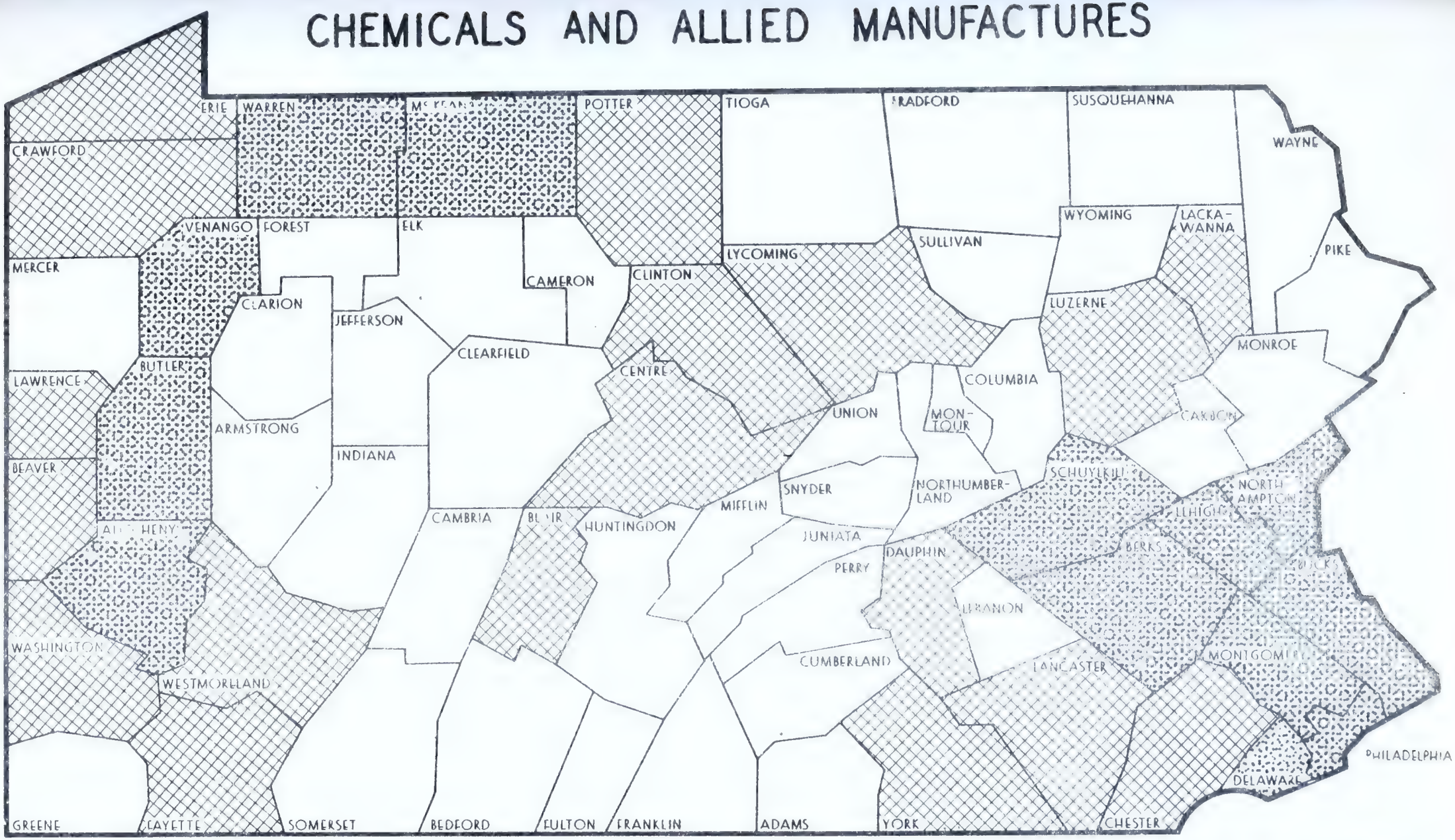
Organic chemistry in the twenty-seven years here under consideration has become one of the most brilliant and progressive branches of applied science, and promises to contribute more products for human use than any other form of technology.

Yet there were in 1941 only twelve counties of the State in which our chemical plants and oil refineries employed more than 500 people. In thirty-four counties these industries employed less than 100.

It has been long known that anthracite producer gas may be used for the synthesis of ammonia and methanol. Natural gas and the coke oven gases and by-products are potential sources for dyestuffs, photographic and industrial chemicals, organic drugs, and for thousands of materials which may have a large part in the shaping of the pattern of a new age. Pennsylvania leads our Nation in the output of coal tar, the richest known source of many of those products which loom so large in the prospects of our industrial future. With an output of scores of millions

1940-41

CHEMICALS AND ALLIED MANUFACTURES



500 OR MORE EMPLOYEES

100 TO 500 EMPLOYEES

0 TO 100 EMPLOYEES

PENNA DEPT OF COMMERCE
STATE PLANNING BOARD

of pounds of the coal tar resins and of 229,000,000 gallons of coal tar and of more than 4,000,000,000 cubic feet of coke oven gas in 1941, the foundation is here for as great a leadership in the organic chemical industry as that of pre-war Germany. That the chemical industries of the Reich will at the close of the war, be able to resume their dominance of many phases of the industry is extremely doubtful. Under these conditions the development of chemical and plastic industries close to the sources of raw materials in the Commonwealth of Pennsylvania offers one of the State's largest opportunities for postwar prosperity.

MISCELLANEOUS - INCLUDING COKE, SHIP BUILDING, AND LAUNDRIES

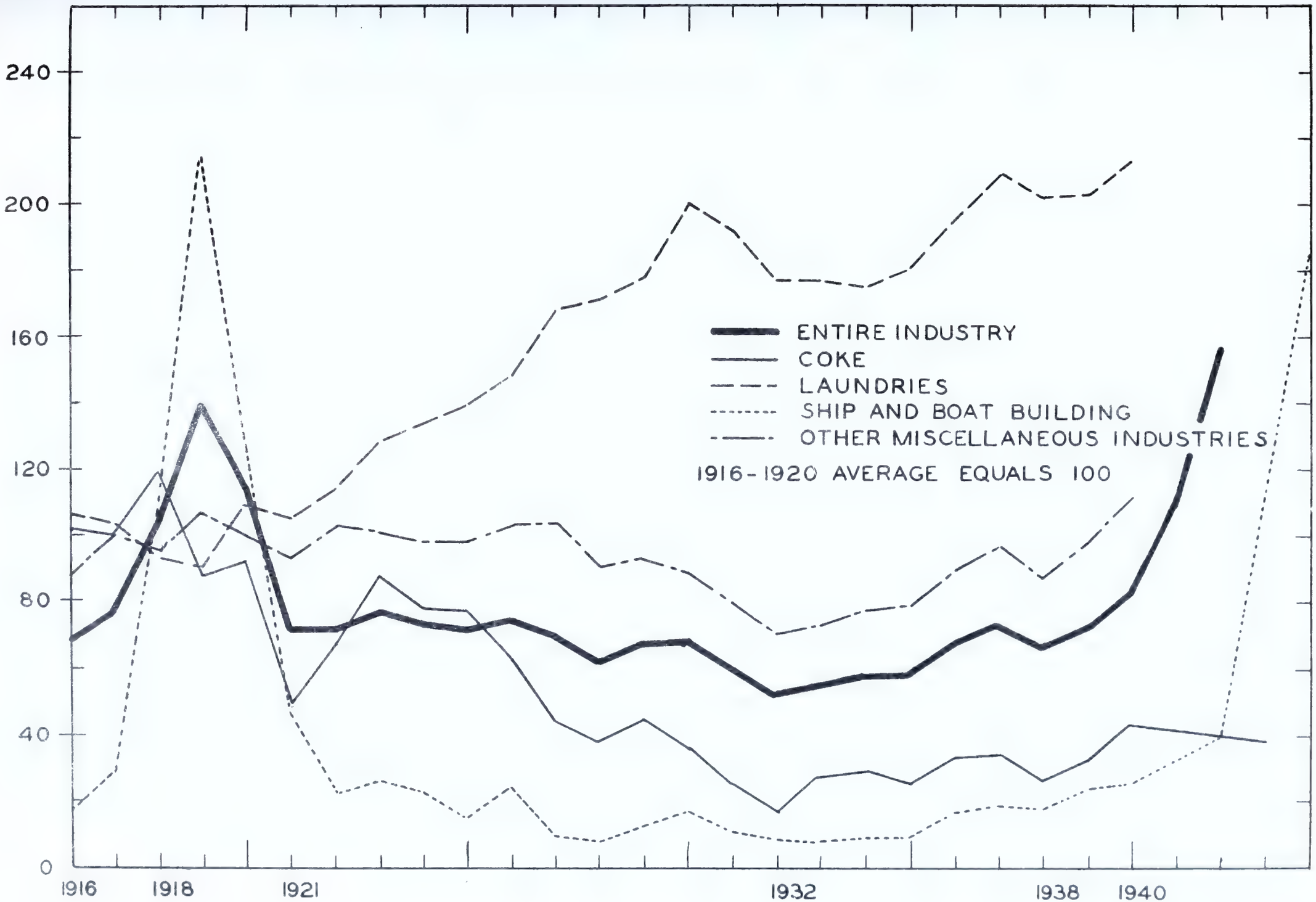
Under the heading, "Miscellaneous Industries", are grouped such unlikely associates as Coke Manufacture, Laundries, Ship and Boat Building, as well as a large number of minor industrial lines. These must, of course, be considered separately.

The growth in laundry employment in Pennsylvania in the twenty-five years under consideration has been remarkable. Employment during the 1916 to 1920 base period averaged 9,960. By 1940 more than 21,000 were employed in the laundry industry and this despite the remarkable improvements which have been made in domestic washing devices of all kinds. This fact clearly illustrates the increasing trend away from domestic laundry work in the Commonwealth. Even at the depth of the 1932 depression employment in the State's laundries was greater than it had been in 1928. Successive employment peaks have been steadily rising, but there is every evidence in this chart that the industry is in a healthy and growing condition.

The curve of employment in the Shipbuilding Industry illustrated in the following chart is one of great significance to all who are facing the problems of the postwar period. While data on shipbuilding employment after 1940 are far from complete, it is well known that an enormous increase has occurred, similar to that witnessed during the years of the First World War when the number of the State's shipyard workers rose from 5,560 in 1916 to 64,906 in 1919. In 1920 employment in this industry fell to 38,519, a decline of more than 40%. In 1921 it had dropped to 14,380 and in 1922 to 6,607. After a brief and irregular recovery in 1926 it declined again in 1928 to a low point of 2,281, little more than 1/30th of its 1919 peak. Shipbuilding has suffered more severe fluctuations during the past quarter of the century than any other in the entire range of Pennsylvania's industries. There are many reasons for this condition. The principal one is, of course, that in the type of global warfare in which we have twice been engaged in

INDICES OF PENNSYLVANIA EMPLOYMENT

MISCELLANEOUS PRODUCTS



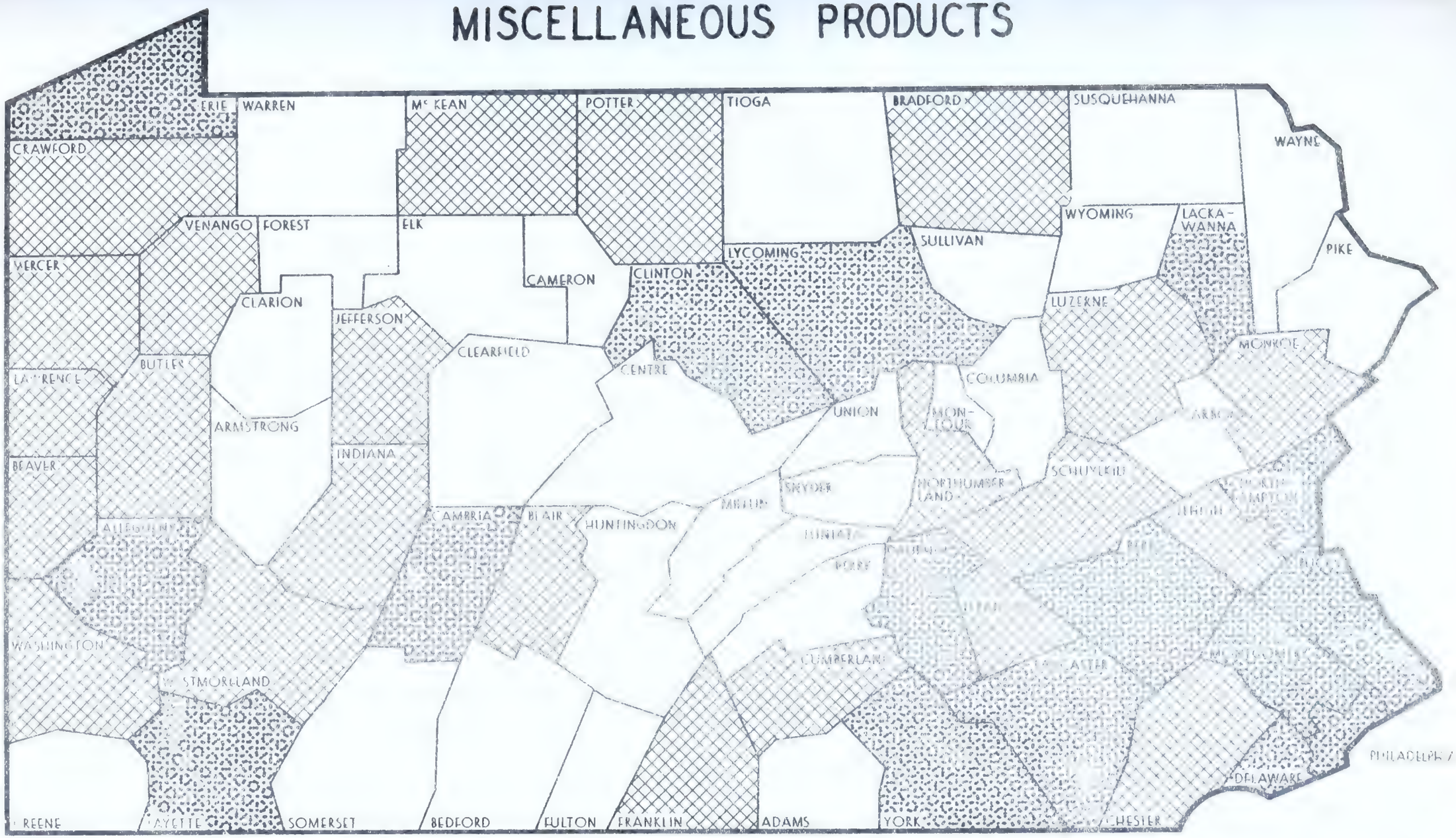
the past generation shipping is of prime importance and the position of the Philadelphia-Chester-Camden area with its access to the State's great steel mills permits a tremendous expansion in shipbuilding capacity. But ships are durable goods, expensive to construct and sufficiently valuable to their owners to be handled with all possible care. They last a long time, and no peace-time needs which have ever developed compare to the load thrown on ocean transportation by the launching and provisioning of a great expeditionary force.

So soon as submarine operations become only a minor menace American shipbuilding capacity is always so great that in the closing years of a war it constructs enough bottoms to supply the Nation's peace-time needs for many years to come. Shipbuilding then becomes largely a matter of supplying liners, small vessels, and pleasure boats and employment sinks to an irreducible minimum. If this phenomenon was observed as a consequence of our somewhat brief engagement in World War I, it appears likely to exist again in an even more exaggerated form at the close of the Second World War. While certain areas in Pennsylvania will be affected by this condition, it is likely that in some of our West Coast states, where shipbuilding has assumed a dominant place in industry, the effect will be extremely severe. The airplane industry, which has now attained a dimension never known in the world before, is likely to experience a similar decline in employment.

The third important component in the group of Miscellaneous Industries is the Coke Industry in which employment declines following the First World War were also drastic and recovery slow after the 1932 depression. This industry is a complex of two methods of manufacture. Beehive coke in which Pennsylvania is the leading American producer, provides considerable employment only at periods when the industrial demand for coke exceeds the capacity of the Nation's by-product plants. It is a form of manufacture in which all of the chemical by-products of high-volatile bituminous coal are lost. Its economies lie in the fact that beehive ovens can be installed close to the mine mouth and can be operated with local labor. During

1940-41

MISCELLANEOUS PRODUCTS



MORE THAN 1,000 EMPLOYEES

100 TO 1,000 EMPLOYEES

LESS THAN 100 EMPLOYEES

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

normal periods in the steel industry, the greatest consumer of coke, the by-product plants which collect and process the tars and gases resulting from coke production dominate the industry because of their efficiency in the use of labor and the importance of their derivatives in the manufacture of ammonia based fertilizer, of various light oils, and of toluol. Improved efficiency in steel production and in other fuel uses make it unlikely that future employment in the coke industry will ever attain the level recorded during the First World War unless the domestic and industrial uses for coke can be greatly expanded and further development occurs in the utilization of coal tar by-products for the manufacture of chemicals and synthetics.

The remarkably steady curves of employment in the fifty or more miscellaneous industries, largely consumer's goods, not included in the above account, which suffered a very minor fall in the 1921 depression and maintained their employment level far better than industry as a whole in the depression of 1932, is an illustration of the value of the diversification of industry in maintaining steady production under all types of economic conditions.

THE PATTERN THAT DEFEATS DEPRESSION

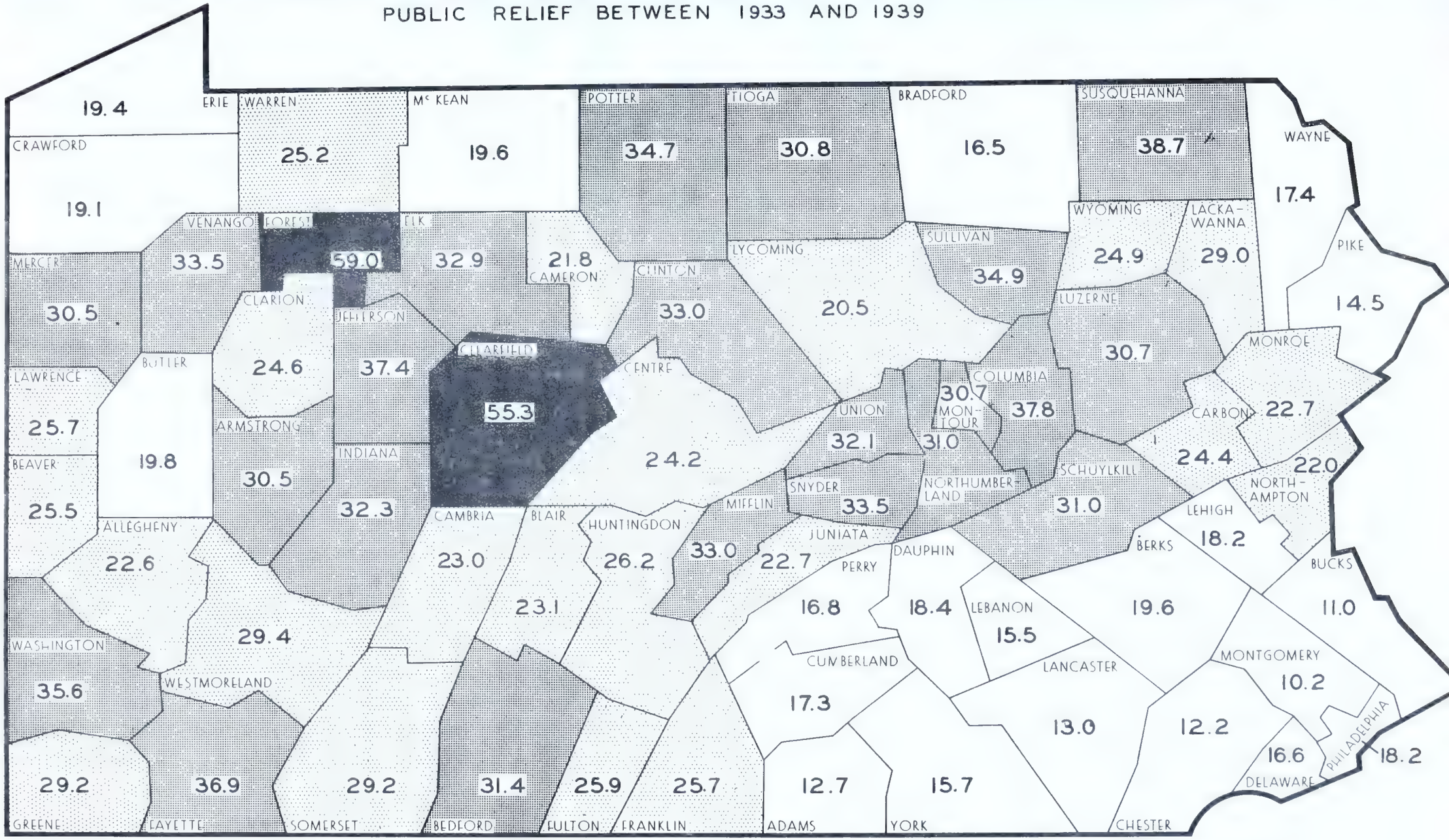
Many lessons can be learned from the history of Pennsylvania's employment and industry during the ten years of the great industrial depression which began in the fall of 1929. A careful examination, county by county, of both the maximum and the average relief load developed during that dark period in our economic history reveals facts which are of positive value for the future.

It will be seen, for instance, from a comparison of State-wide data as to the sources of each county's employment during that depression period that counties with the highest per capita income from agriculture almost uniformly stood lower than others in their average and maximum relief load. This correlation is positive and unmistakable. A prosperous agricultural background is the best assurance any county can have of its freedom from the most serious phase of industrial depression. Prosperous agriculture is a positive protection against a heavy relief load. This, however, does not mean that farming is, of itself, an unfailing resource in bad times. There is little or no connection between the percentage of a county's area in farm land and the freedom from the heavy burdens of unemployment and relief. It is only the value of the farm products, both absolutely and per capita, which offer that insurance.

A similar (though not quite so high) correlation exists between the number of sources of county employment including trade, farming, and the various classes of industry, and a lower relief load. Counties with a high degree of diversification as determined by the number of important employment sources tend to have a lower relief load than counties in which the number and types of employment are more limited. The effect of such diversification is more certainly felt in those counties where the leading source of manufacturing employment is in the production of consumer goods.

HIGH POINT IN PENNSYLVANIA UNEMPLOYMENT

HIGHEST PERCENTAGE OF EACH COUNTYS POPULATION DEPENDENT UPON PUBLIC RELIEF BETWEEN 1933 AND 1939



DATA FROM PENNA. DEPT. OF PUBLIC ASSISTANCE.

0 TO 20%
20 TO 30%
30 TO 50%
OVER 50%

NOTE - AT THE HIGH POINT IN UNEMPLOYMENT
21% OF OUR POPULATION WAS ON RELIEF

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

Both maximum and average relief loads during the period of the depression fell lightest on industrial counties whose important sources of employment were directly connected with the various types of consumer need. These findings lead to conclusions which have already been discussed elsewhere in this summary. While many of the leading sources of the wealth of this State lie in its production of coal, iron, steel, and other raw materials, it must never be forgotten that the destination of all produced wealth is the ultimate consumer. In times of stress and uncertainty he buys for his immediate wants only those goods which are necessary to his health and wellbeing and it is only by such purchases in times of doubt and temporary unemployment that the stream of our industrial life continues to flow. Farm produce and consumer's goods, such as, clothing, shoes, material for repairs of existing machinery, and necessary domestic and transportation equipment provide continuous employment even in the very worst of times.

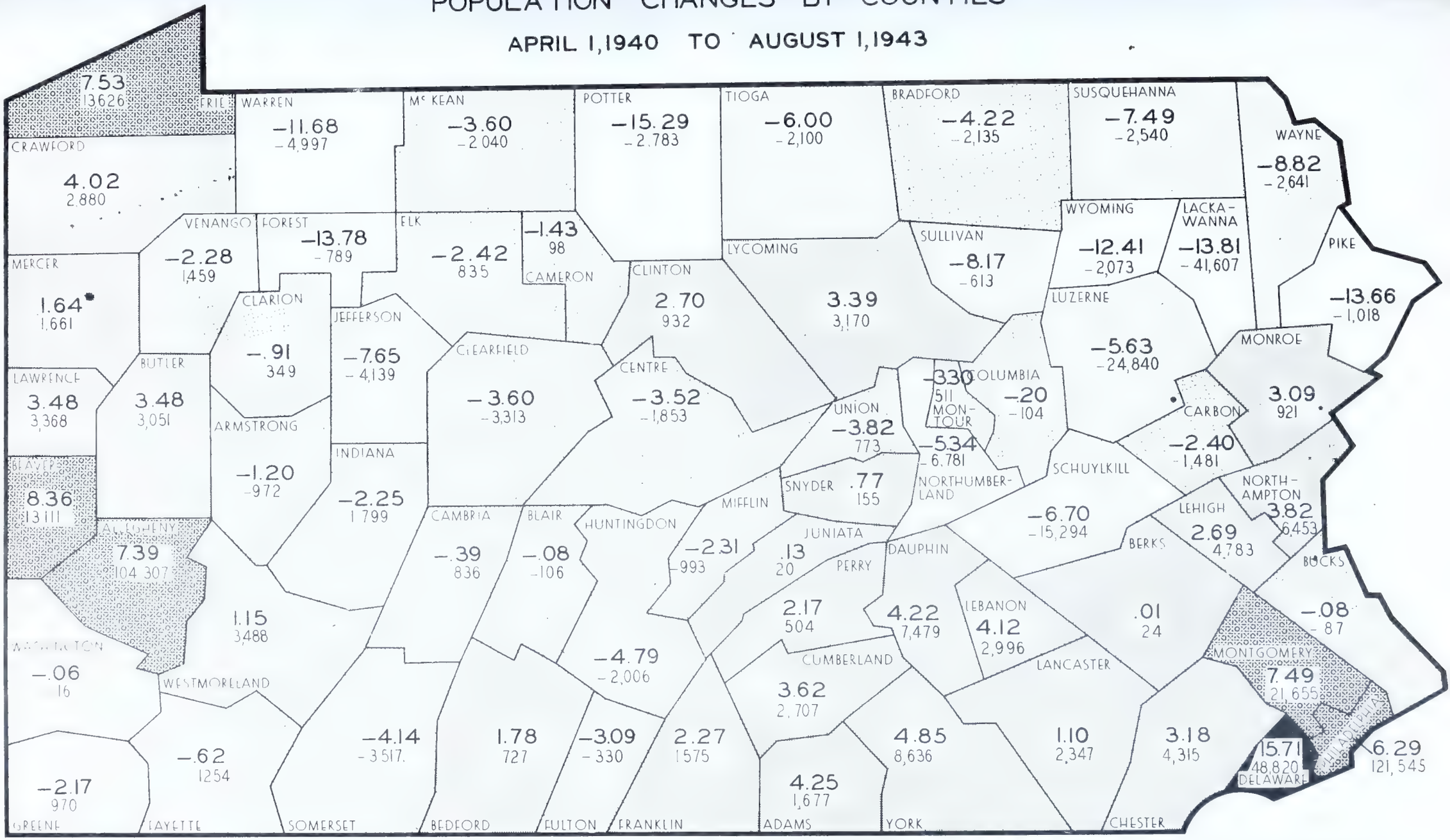
Unless these facts are considered, diversification of a county's industrial pattern may not always provide the desired security against the impact of hard times, nor does the concentration of a county's industry in the production of an expanding type of consumer goods always prove an adverse factor, though it unquestionably does introduce an element of risk into the county's industrial picture which can be offset only by an increase in the number of other types of industry.

Exceptional cases are certain to occur, but <u>over the longer term counties with a comparatively large number of industries</u>, <u>balanced between producer and consumer goods</u>, and <u>with a solid background of productive agriculture have weathered the industrial storms of the past twelve years far better than any other</u>.

****

POPULATION CHANGES BY COUNTIES

APRIL 1, 1940 TO AUGUST 1, 1943



GAINS

- OVER 10%
- 5% TO 10%
- 0 TO 5%

LOSSES

- 0 TO 5%
- 5% TO 10%
- OVER 10%

UPPER FIGURE — PERCENTAGE CHANGE

LOWER FIGURE — NUMERICAL CHANGE

PENNA. DEPT. OF COMMERCE
STATE PLANNING BOARD

MANUFACTURING AND EXTRACTIVE INDUSTRIES

EXCEPT RAILWAY REPAIR SHOPS

1916 to 1920 av. = 100

YEAR	VALUE OF PRODUCT	CAPITAL INVESTED	COMPENSATION	EMPLOYEES	ESTABLISH-MENTS
1916	$ 5,958,821,000	$2,912,131,000	$1,123,499,000	1,481,620	17,169
1917	7,802,631,000	3,569,341,000	1,431,565,000	1,527,198	18,007
1918	8,739,837,000	3,842,916,000	1,903,458,000	1,545,851	17,285
1919	8,026,393,000	4,330,362,000	1,951,426,000	1,518,513	16,988
1920	10,336,064,000	4,975,560,000	2,453,872,000	1,599,682	21,254
1921	5,836,251,000	4,758,961,000	1,671,904,000	1,331,923	20,595
1922	6,624,257,300	4,897,628,000	1,607,745,000	1,403,329	19,800
1923	8,629,122,000	5,116,503,000	2,203,959,000	1,513,496	18,410
1924	7,439,762,000	5,249,867,000	2,021,975,000	1,419,275	17,353
1925	7,596,090,000	5,377,301,000	1,977,306,000	1,425,951	16,815
1926	7,789,603,000	5,479,110,000	2,141,588,000	1,451,987	16,732
1927	7,310,256,000	5,460,081,000	2,093,610,000	1,443,064	19,457
1928	7,325,810,000	5,397,665,000	2,031,991,000	1,397,435	18,640
1929	7,998,086,000	5,514,863,000	2,166,271,000	1,442,874	18,592
1930	6,531,113,000	5,498,543,000	1,888,765,000	1,357,711	20,065
1931	4,572,738,000	5,252,452,000	1,431,211,000	1,186,307	19,108
1932	3,039,284,000	4,891,428,000	985,479,000	1,015,318	18,014
1933	3,414,263,000	4,706,199,000	1,016,950,000	1,101,783	18,368
1934	4,145,527,000	4,466,364,000	1,259,986,000	1,185,503	17,956
1935	4,650,762,000	4,324,743,000	1,367,093,000	1,222,349	17,884
1936	5,911,468,000	4,167,174,000	1,598,538,000	1,321,069	17,757
1937	6,734,523,000	4,224,316,000	1,853,326,000	1,402,452	17,710
1938	4,759,188,000	4,148,164,000	1,433,765,000	1,219,036	17,065
1939	5,581,912,000	4,109,736,000	1,638,211,000	1,284,921	16,932
1940	6,677,258,000	4,089,071,000	1,866,432,000	1,377,504	17,141
1941	9,312,181,000	4,180,046,000	2,568,415,000	1,596,675	17,098
1942	11,844,256,000	4,353,214,000	3,303,018,000	1,716,713	17,067

INDEX FOR MANUFACTURING AND EXTRACTIVE INDUSTRIES

EXCEPT RAILROAD REPAIR SHOPS

1916 to 1920 = 100

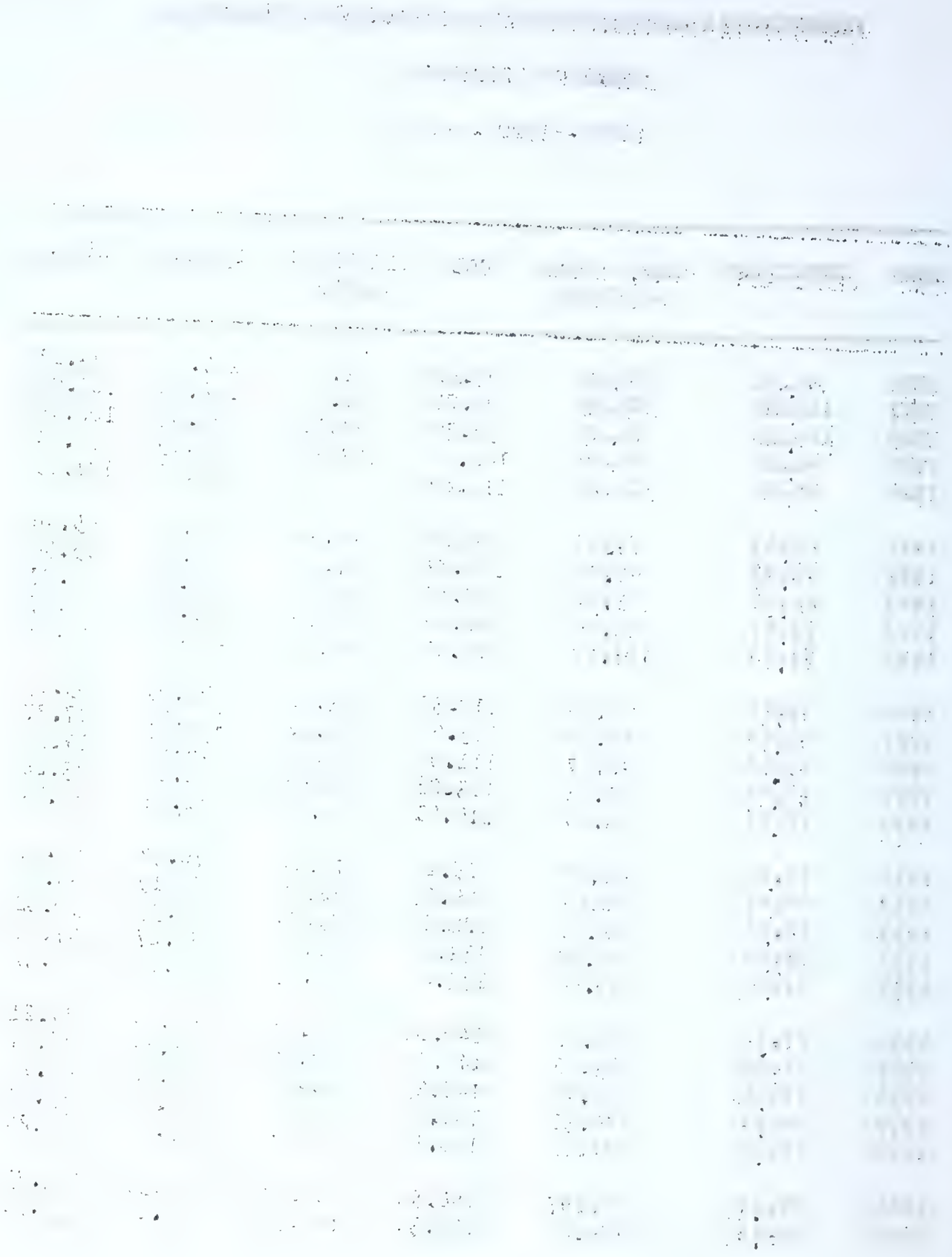
YEAR	VALUE OF PRODUCT	CAPITAL INVESTED	COMPENSATION	EMPLOYEES	ESTABLISHMENTS
1916	72.91	74.17	63.38	96.55	94.64
1917	95.47	90.91	80.75	99.52	99.26
1918	106.94	97.88	107.37	100.73	95.28
1919	98.21	110.30	110.08	98.95	93.65
1920	126.47	126.73	138.42	104.24	117.16
1921	71.41	121.21	94.31	86.79	113.53
1922	81.05	124.75	90.69	91.45	109.15
1923	105.58	130.32	124.32	98.61	101.49
1924	91.03	133.72	114.06	92.49	95.66
1925	92.94	136.96	111.54	92.92	92.69
1926	95.31	139.56	120.81	94.62	92.24
1927	89.46	139.07	118.10	94.04	107.26
1928	89.64	137.48	114.62	91.06	102.75
1929	97.86	140.47	122.20	94.02	102.49
1930	79.91	140.05	106.54	88.47	110.61
1931	55.95	133.78	80.73	77.31	105.33
1932	37.19	124.59	55.59	66.16	99.30
1933	41.78	119.87	57.37	71.80	101.25
1934	50.72	111.76	71.07	77.25	98.98
1935	56.91	110.15	77.12	79.65	98.59
1936	72.33	106.14	90.17	86.09	97.89
1937	82.40	107.60	104.54	91.39	97.63
1938	58.23	105.66	80.88	79.44	94.07
1939	68.30	104.68	92.41	83.73	93.34
1940	81.70	104.15	105.28	89.11	94.49
1941	114.05	106.48	144.88	104.05	94.25
1942	144.83	110.88	186.32	111.87	94.07

PENNSYLVANIA MANUFACTURING AND EXTRACTIVE INDUSTRIES

INDEX OF EMPLOYMENT

(1916 - 1920 = 100)

YEAR	CHEMICALS	CLAY, GLASS & STONE	FOOD	LEATHER & RUBBER	LUMBER	METALS
1916	95.52	108.88	93.66	101.2	105.81	94.27
1917	100.88	108.20	95.28	97.14	102.36	104.99
1918	109.16	91.09	96.34	93.31	93.83	108.45
1919	98.64	90.50	102.83	107.36	99.09	90.64
1920	95.79	101.32	111.89		98.91	101.65
1921	69.63	79.13	96.29	93.97	85.91	65.46
1922	70.72	90.00	105.83	97.24	95.99	75.56
1923	76.18	101.02	107.85	98.74	102.46	88.07
1924	73.67	96.16	108.66	85.18	99.45	80.77
1925	74.79	101.52	107.97	84.64	102.98	80.82
1926	79.28	99.58	110.30	83.62	99.09	83.63
1927	76.74	95.32	113.97	89.62	102.27	77.77
1928	75.60	92.87	111.92	87.19	94.02	77.17
1929	78.49	93.31	113.26	86.63	91.14	83.26
1930	77.93	83.35	116.71	80.91	82.95	74.14
1931	77.80	69.12	115.20	76.42	70.37	57.77
1932	68.47	56.37	106.07	72.77	56.19	43.76
1933	75.63	62.46	122.26	75.09	58.39	50.02
1934	85.68	70.59	133.42	81.04	56.27	57.85
1935	84.20	72.56	133.64	84.63	60.78	62.31
1936	87.44	78.26	140.02	85.28	68.14	74.21
1937	91.08	83.42	144.43	92.29	71.81	84.81
1938	79.86	69.40	142.23	91.36	63.08	65.76
1939	84.27	76.32	144.58	99.61	67.99	73.84
1940	78.65	84.42	148.19	99.05	69.17	87.25
1941	89.12	98.97	156.50	110.32	77.39	113.75
1942	98.21	100.80	158.34	108.33	72.10	128.56



PENNSYLVANIA MANUFACTURING AND EXTRACTIVE INDUSTRIES

INDEX OF EMPLOYMENT

(1916 - 1920 = 100)

YEAR	MINE & QUARRY	PAPER & PRINTING	TEXTILES	TOBACCO	MISCELLANEOUS
1916	106.07	95.18	96.39	96.34	67.82
1917	96.17	96.86	100.65	96.51	76.03
1918	96.37	93.78	95.79	87.10	103.75
1919	100.41	105.82	101.68	95.16	138.64
1920	100.98	108.36	105.48	124.90	113.75
1921	112.52	101.19	103.94	117.02	71.43
1922	108.01	108.00	108.01	114.21	70.78
1923	112.04	111.18	111.42	111.50	76.24
1924	104.39	112.53	104.81	105.00	73.13
1925	101.30	113.04	111.64	101.45	71.16
1926	103.43	114.91	110.68	103.87	74.32
1927	103.20	122.03	121.91	100.26	69.57
1928	94.91	116.47	123.40	96.04	62.43
1929	92.45	120.68	128.25	86.33	67.06
1930	91.61	118.13	121.26	80.70	68.33
1931	80.89	111.53	114.53	72.12	59.99
1932	68.27	103.87	108.63	65.31	52.28
1933	68.22	108.87	121.24	64.14	55.26
1934	72.00	112.01	123.09	67.30	57.54
1935	70.13	114.69	129.64	63.17	57.61
1936	71.19	120.38	131.56	63.58	67.53
1937	70.25	126.27	134.00	63.20	72.96
1938	64.03	122.10	120.82	59.98	66.83
1939	61.41	126.93	124.57	58.32	73.49
1940	61.78	129.61	125.41	56.48	83.10
1941	61.18	135.89	133.73	59.14	109.53
1942	63.64	129.18	128.04	56.75	156.50

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RETAIL TRADE IN PENNSYLVANIA



MARCH 1946

PENNA. DEPT. OF COMMERCE

STATE PLANNING BOARD

8.49
2.10

ANALYSIS OF RETAIL TRADE IN PENNSYLVANIA

At the time of the last Census Pennsylvania's retail stores gave employment to nearly 348,000 workers and paid out $339,000,000 in wages. They also supported 125,532 active owners so that 473,000 were directly earning their livelihood by retail business. Retail trade is, therefore, one of our most important sources of employment. Total retail sales in 1939 were $3,133,377,000 and it must be remembered that 1939 was not a year of high prosperity.

Many returning servicemen and those who have recently been employed in war industry are now turning their attention to the possibility of establishing some type of retail store, restaurant, or service shop to take advantage of the decline in the number of such stores during the years of war. Inquiries come in daily to the Pennsylvania Department of Commerce as to suitable locations for such enterprises.

It is certain that thousands of new stores will be opened within the next few years and that a large number will meet with success and that many will fail. A man undertaking such an enterprise has many factors to consider, since the success of a retail establishment depends very largely upon the combination of six qualities:

Experience
Initiative
Dependability
Capital
Personality
Location

All these are important.

Inadequate capital is listed as the cause of business failure more often than any other strictly economic factor, but the

personal qualities of knowledge, initiative, reliability, and a pleasing personality can not be measured by statistics. A large number of stores which have failed for lack of adequate capital have done so because the proprietor of the business was lacking in special knowledge of his line of trade or in personal qualities necessary to attract and hold customers. Or it may have been that he chose a location which required large capital to insure success, or one in which success for his particular type of store or shop was practically impossible.

Location is, therefore, only one of many factors, but an unsuitable location is a positive handicap and a good location a positive asset. In the competition for business success no one can afford to accept any needless handicaps, nor is it necessary for him to do so in the matter of finding a promising place for his store within the State of Pennsylvania.

One may well start out with this certainty. Somewhere in Pennsylvania is the right place for almost every conceivable type of retail outlet. Our people are a settled people. Far more than those of most states they own their homes or farms and keep them. Every year they spend billions of dollars for goods and services. Every year visitors from other states spend hundreds of millions in Pennsylvania. These facts spell oportunities in retail trade. But in locating a store a man or woman must consider first the limitations imposed by his capital, his experience and his personal qualities. Has he the means to face big city competition? Has he the special information which is necessary to insure success in the particular line of retail trade he is intending to follow? Or has he the temperament to be happy and work long hours in a small

town or rural neighborhood? With what kind of people does he get along best? These are vital questions. They guide in determining a suitable location. Once they are settled the prospective merchant can still further narrow his search.

Where a man is best known and has made friends is usually the best place for his enterprise. But there may be good reasons against such a choice. The locality may be over-crowded in the line of business he intends to follow. It may offer no opportunity for the use of his special knowledge. Or he may desire the stimulus of new surroundings. But Pennsylvania is a large state, big enough and varied enough for every type of business opportunity, and it is not likely a Pennsylvanian will need to go outside the boundaries of the Commonwealth to find a location that will offer him adequate opportunity.

In nearly all market guides a considerable number of sales factors bearing upon earning power, or capacity to buy are usually listed. A comparison of a number of such economic factors with the sales per store in Pennsylvania counties indicates that there is a very high correlation between the income tax returns per hundred people in a community and the average sales per store in retail establishments. There is also a high correlation between the number of passenger cars registered in a county and the number of sales per store. The size of the total population of the county has a fairly high correlation to sales per store and the total compensation in all manufacturing establishments has a moderately high correlation. Some of these factors are listed in tables accompanying this text.

Since the most frequent question asked by those intending to establish a new store in a certain locality concerns the number of other similar stores within the area a special study has been made of

the relationship between the number of stores in a county or city and the average sales per store.

Perhaps the greatest value of the results attained by this investigation is to demonstrate how differently, for various types of retail outlet, the number of people per store in a community is related to the volume of retail sales and in what lines this factor is of most importance. In food stores, for instance, where purchases are generally made in the immediate neighborhood of the home, the number of people per store in a locality is closely related to sales, though other factors such as the percentage of people living on farms in the community would of course influence the amount of food purchased.

Commodities which are bought less frequently show a different pattern of distribution of sales per store, particularly where such commodities may be bought by mail, or where a large variety of choice is possible only in the stores of larger cities.

In dealing with commodities which are purchased very infrequently, such as automobiles, it is found that sales per store tend to depend rather on community wealth than upon the number of outlets per thousand in the population.

In some lines the effect of excessive competition in producing a decline in sales volume is quite evident from the charts and tables which accompany this study. It is also clear that in lines where such factors operate with the greatest force there is often no advantage in a retail location in a large city except for a merchant with ample capital.

But competition is not, of itself, an undesirable factor in determining a business location in many retail lines. In any city, stores

carrying similar lines of goods tend to establish themselves in close proximity. Sections of a city well known for their department stores, antique stores, book stores, and fur shops come to be well defined. Buying habits are frequently established by competitive efforts to popularize new types of goods. Competition is hurtful only when the number of stores is excessive as shown by the record of low average of annual sales per store.

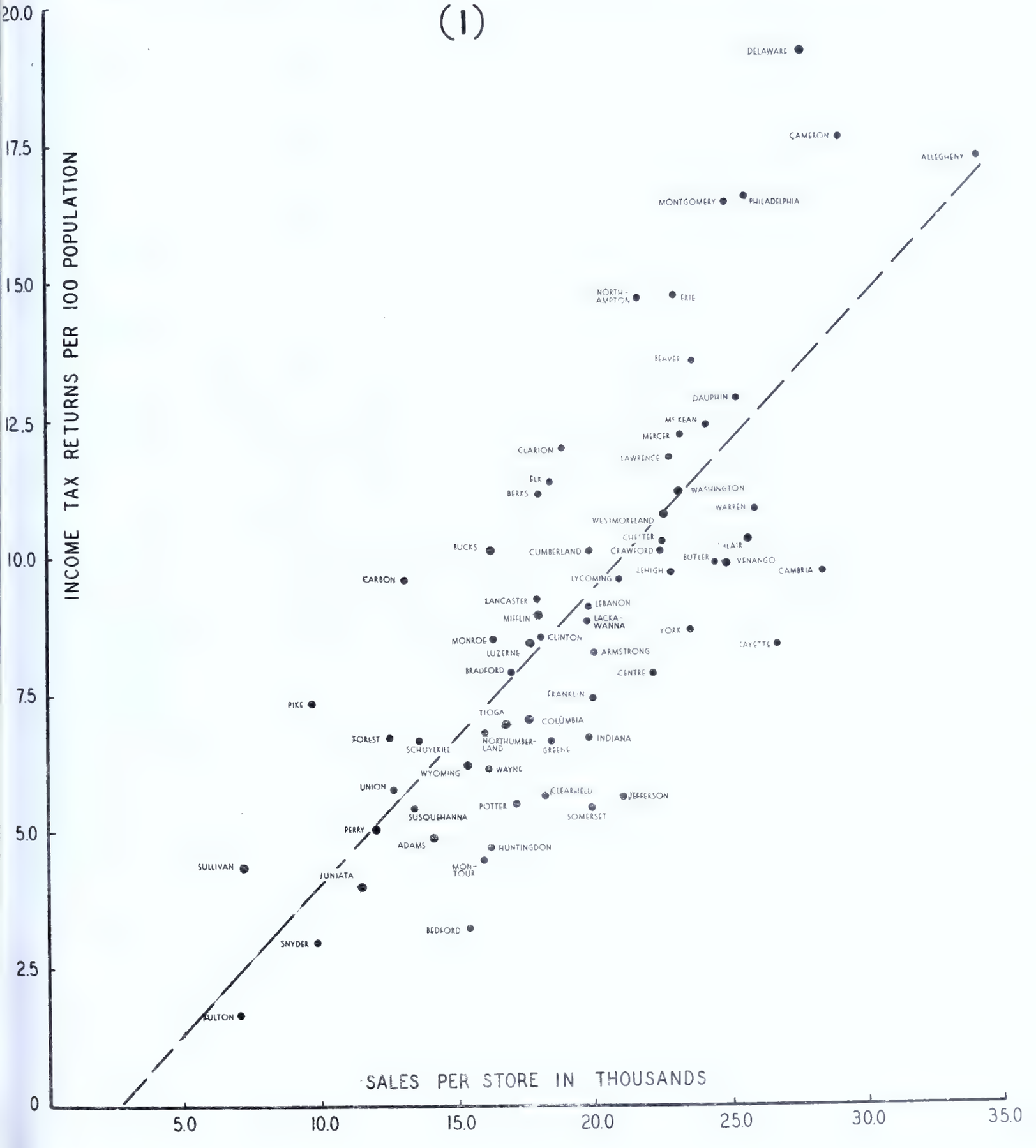
These data and charts then must be considered as background facts in determining location for new retail enterprises and serve to determine the type of effort which must be put forth in a given location. They do not offer a guide towards success or a warning against failure -- for failure or success depend, as was said at the beginning of this booklet, on the individual, his enterprise, his knowledge, his capital and his ability to build good will.

THE RELATION BETWEEN INCOME TAX RETURNS AND VOLUME OF RETAIL SALES

The accompanying chart (Chart 1.) shows the close correlation existing between the income tax returns per hundred people in a county and the sales per store in all retail stores. A careful comparison of the placement of counties on this chart with that showing relation between average sales and population per store (Chart 2.) may indicate the generally favorable locations for a new enterprise on the basis of income tax returns in the county and the number of retail outlets. But it must again be emphasized that such purely statistical factors are often of much less moment than the personality, enterprise and willingness to provide unusual services on the part of the proprietor of a retail store or service establishment.

RELATION BETWEEN INCOME TAX RETURNS AND SALES PER STORE

(1)



right of the indicated line, whether the population per store is high or low, the general indication is that in the county or community picture average sales are favorable. A position far to the left of the line indicates that average sales are usually low whether from competitive influences or because of the prevailing type of stores or the purchasing power or buying habits of the community. If the center line slants very sharply to the right as it approaches the top of the chart, the indication is that population per store is an important influence in determining average sales. The closer the line approaches a vertical position the less important that factor is likely to be. If the line slants toward the left as it approaches the top as in the case of apparel stores or service shops, the indication is that other influences are far more important that population per store in determining the average sales in that particular line of retail enterprise.

It is obvious from the various charts shown in this booklet that the number of stores per hundred in the population can be taken as a rough guide to the choice of a location only in certain lines of merchandising, and that this factor must always be checked against such other considerations as community income, community enterprise, and the buying habits of the surrounding area.

Chart No. 2

All Retail Stores

In 1939 there were 134,542 retail stores in Pennsylvania not including service shops. Sales totaled $3,133,344,000, an average of $23,300 per establishment. There was one store to every 74 people.

A chart (No. 2) of all retail establishments plotted against each county's population per store shows a distribution with a definite trend toward larger sales at a higher per store population, as would be expected. It also shows that in general the counties with the highest sales at any given level of population-per-store are likely to be urban or industrial, and that those with comparatively low sales at a given population-per-store are usually rural and non-industrial. Exceptions to this rule must be explained by peculiar local conditions. Such counties as Monroe, Pike and Sullivan which have a low population per store with comparatively low sales are in areas in which a large summer population justifies the existence of a number of retail outlets open chiefly during the vacation season, so that the position of such counties in the chart is influenced by two factors: first, that the permanent population of the county is much lower than its summer population; and second, that a considerable part of the annual sales recorded occur during only a few months in the year.

ALL RETAIL STORES (2)

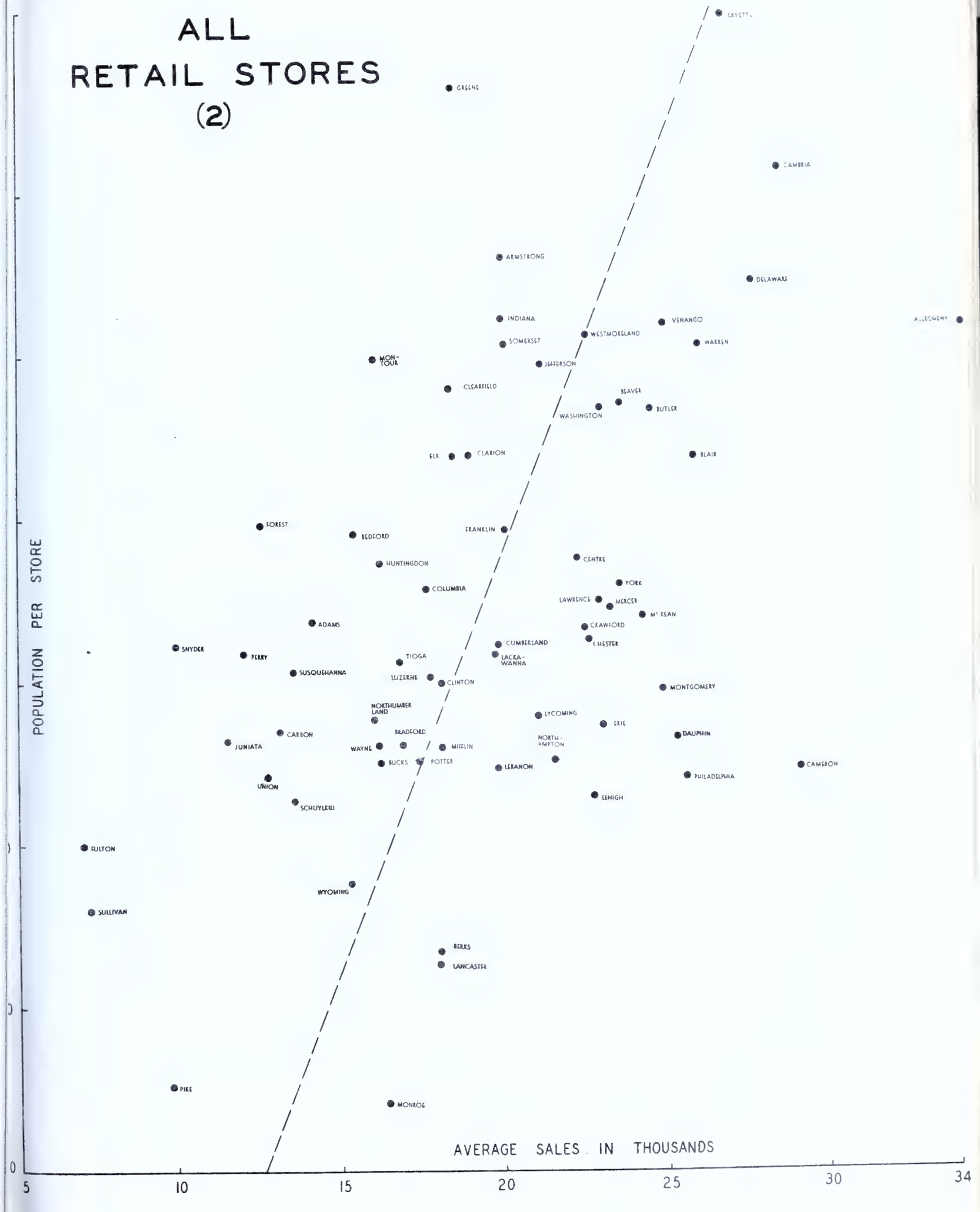


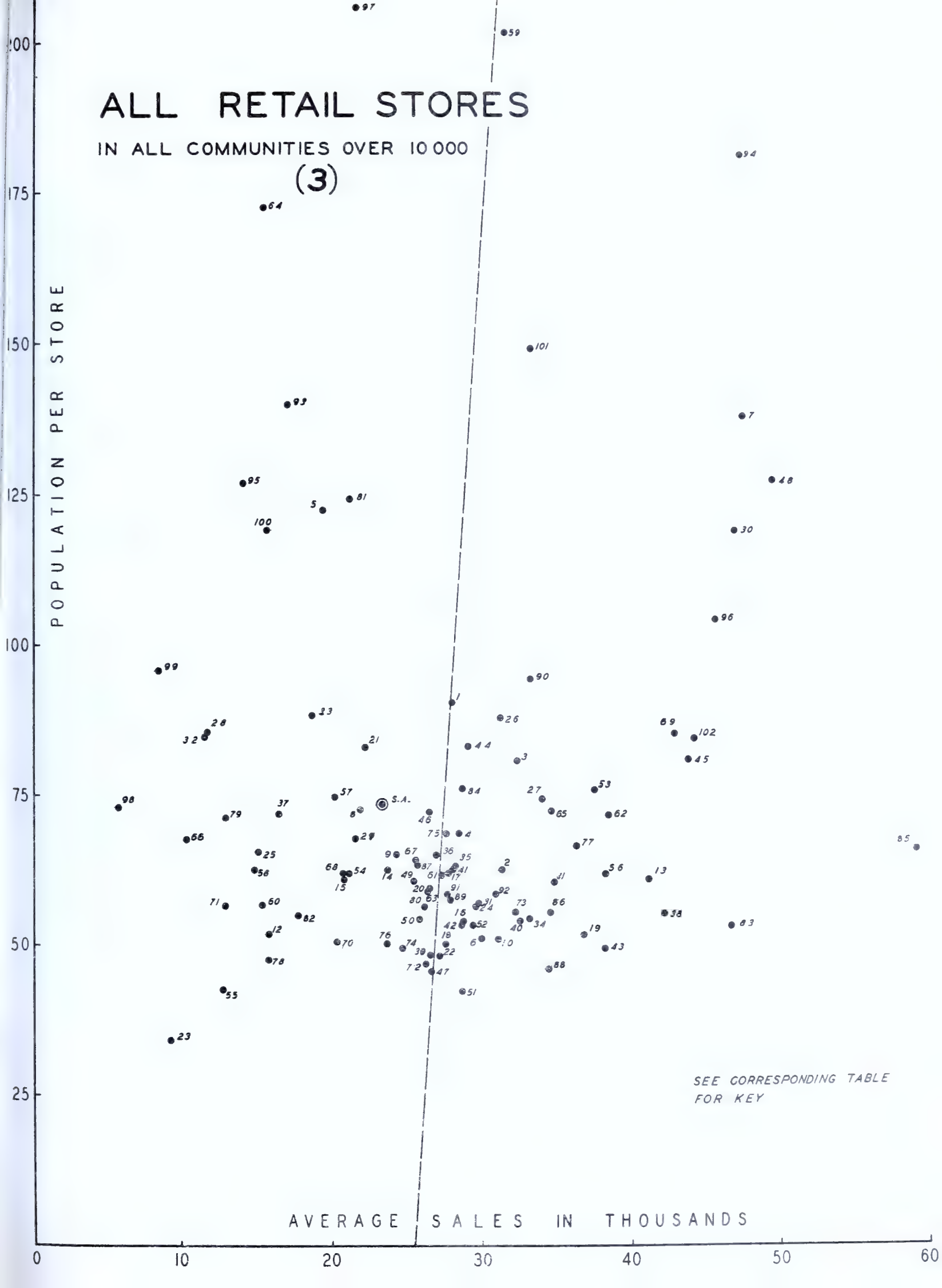
Chart No. 3

Sales of All Retail Establishments

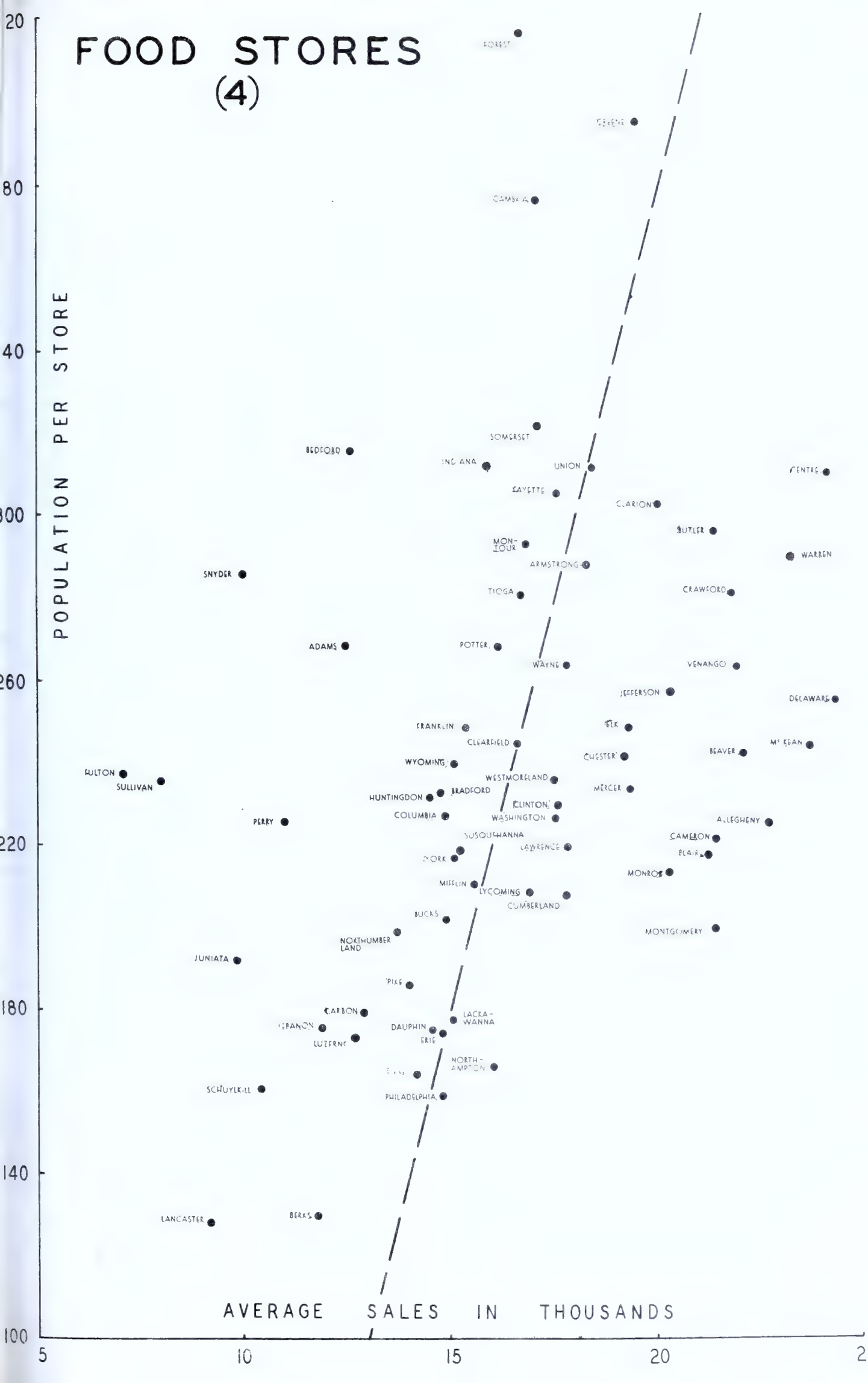
In Chart No. 3, all retail sales in Pennsylvania cities and towns of 10,000 population and over are plotted against population per store. Since we are here dealing with urban communities exclusively, some of the influences which operate in a county area are no longer so important. There is a marked congestion at the population level of from 50 to 75 persons per store which seems to represent the nominal business density of the average urban community, but it will be seen that there are extreme departures from such a norm.

Such communities as Haverford Township, Mount Lebanon Township and Munhall, located at the extreme top of chart with a comparatively high population per store, are all within easy communication of a large city. Their location on the chart relative to the line of best fit is rather an indication of the buying habits of the community than an index of total purchasing power.

It may, however, be possible through a careful study of this chart, to discover communities generally favorable to the location of a retail store. It will then be necessary to examine the community's position in regard to the specific type of business in which one intends to engage and to consider the many other factors than that of average sales per store which may determine business prosperity in that community.


ALL RETAIL STORES
IN ALL COMMUNITIES OVER 10 000
(3)
POPULATION PER STORE
AVERAGE SALES IN THOUSANDS
S.A.
SEE CORRESPONDING TABLE FOR KEY
0
10
20
30
40
50
60
25
50
75
100
125
150
175
200

FOOD STORES (4)



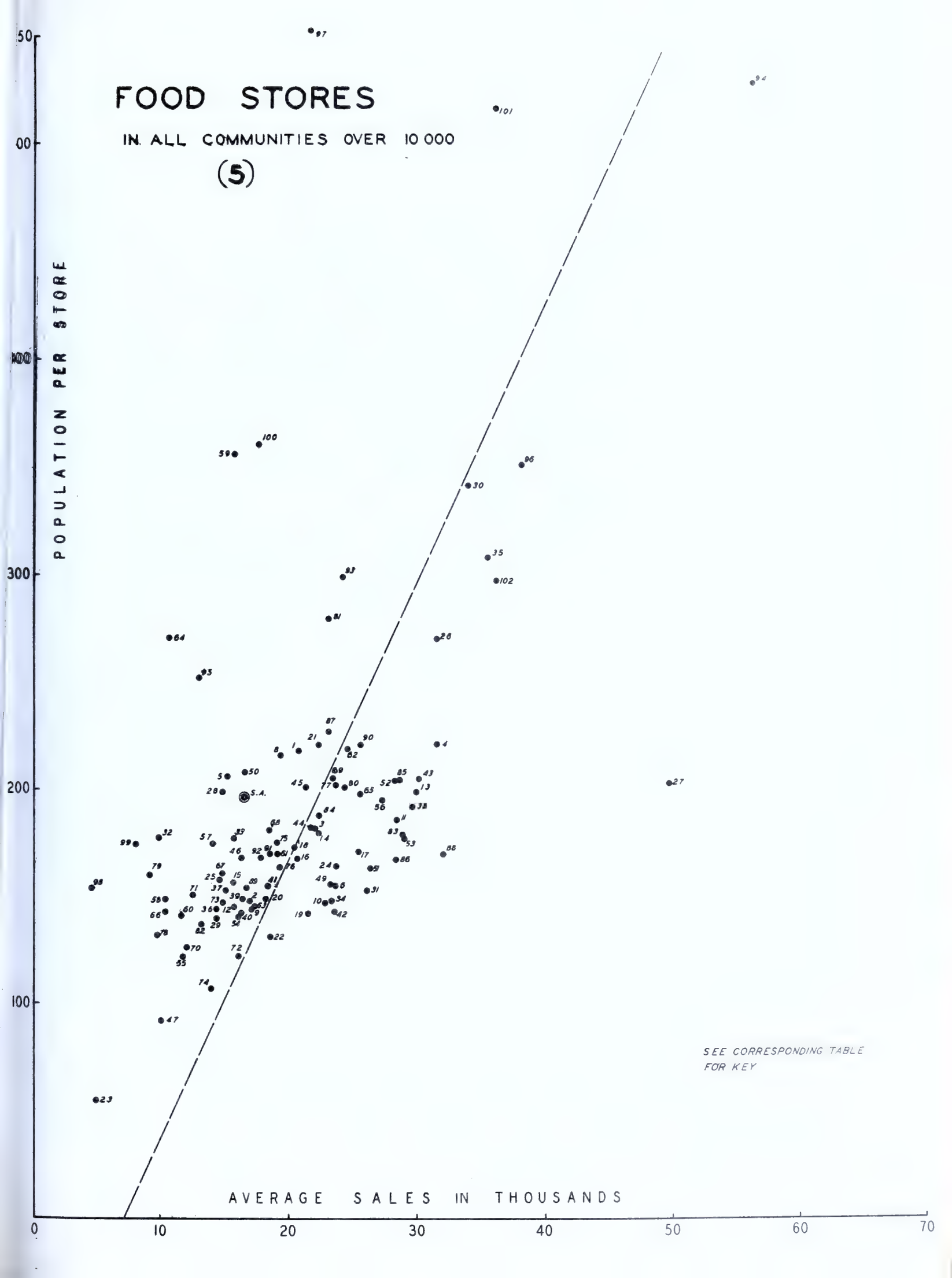

FOOD STORES
IN ALL COMMUNITIES OVER 10 000
(5)
POPULATION PER STORE
AVERAGE SALES IN THOUSANDS
SEE CORRESPONDING TABLE FOR KEY
50
00
300
200
100
0
10
20
30
40
50
60
70
S.A.

Chart No. 6

Restaurants

Sales in restaurants do not follow the same pattern of distribution as sales in food stores. The evidence of this chart is that the value of annual sales in a county is little affected by the number of people to each establishment. Other factors are of greater importance. The eating habits of the community, its economic level, the number of transients, and, particularly in urban communities, the number of unmarried workers dependent on restaurants for their food, all determine the size of average annual sales. But again it must be noted that in urban communities the higher cost of operation is an equalizing factor. In this type of enterprise, more than perhaps any other, special knowledge and skill is needed to build up and hold a profitable clientele. A successful restaurant does not sell only food. It sells pleasant atmosphere, good cooking, and courteous service. For establishments which do not provide some or all of these essentials the mortality rate is very high.

In 1939 Pennsylvania had 10,067 public eating places which did an annual business of $132,746,000. There was an average of one restaurant to every 980 people and an average annual business of $13,200 per establishment.

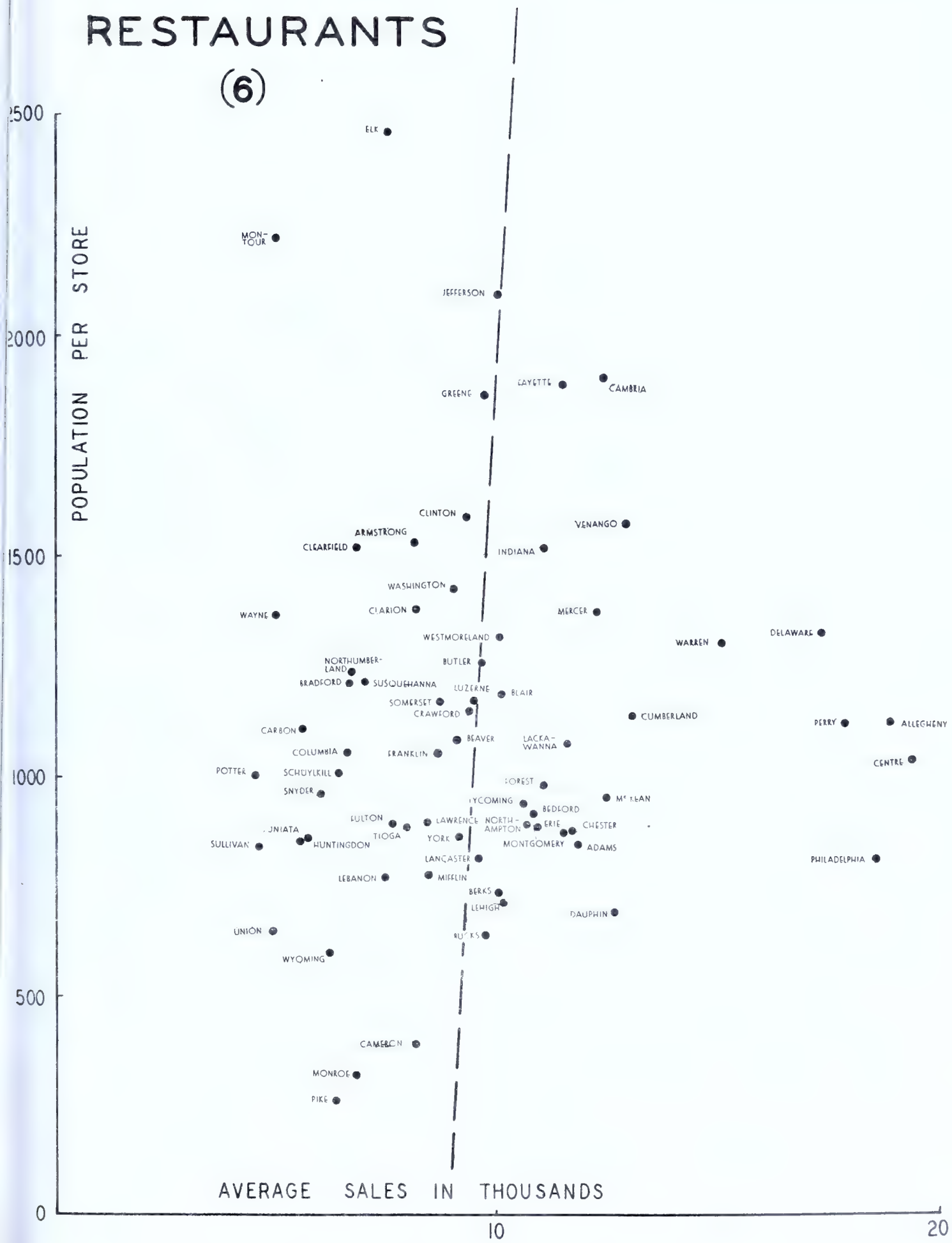

RESTAURANTS
(6)
POPULATION PER STORE
2500
2000
1500
1000
500
0
AVERAGE SALES IN THOUSANDS
10
20
ELK
MON-
TOUR
JEFFERSON
GREENE
FAYETTE
CAMBRIA
CLINTON
VENANGO
ARMSTRONG
CLEARFIELD
INDIANA
WASHINGTON
WAYNE
CLARION
MERCER
WESTMORELAND
WARREN
DELAWARE
NORTHUMBER-
LAND
BUTLER
BRADFORD
SUSQUEHANNA
LUZERNE
BLAIR
SOMERSET
CRAWFORD
CUMBERLAND
PERRY
ALLEGHENY
CARBON
BEAVER
LACKA-
WANNA
COLUMBIA
FRANKLIN
CENTRE
POTTER
SCHUYLKILL
SNYDER
FOREST
LYCOMING
Mc KEAN
BEDFORD
FULTON
LAWRENCE
NORTH-
AMPTON
ERIE
CHESTER
JUNIATA
TIOGA
YORK
SULLIVAN
HUNTINGDON
MONTGOMERY
ADAMS
LANCASTER
PHILADELPHIA
LEBANON
MIFFLIN
BERKS
LEHIGH
DAUPHIN
UNION
BUCKS
WYOMING
CAMERON
MONROE
PIKE

Chart No. 7

Furniture & Radio Stores

The sharp trend of the median line to the right indicates a keen competitive situation in this class of establishment. Widespread variation among the counties in the placement to the right and left of the line points to a far greater difference in local buying habits than is to be found among food stores, restaurants or retail establishments as a whole. While a comparatively large number of people per store is a strong influence toward greater sales, there is evidence in this chart for the conclusion that the more remote the location of the county from large urban centers, or the more scattered its population, the less its people are likely to buy their furniture or radios from local sources of supply, or the less they are likely to buy any of these commodities at all.

Pennsylvania's 4,012 furniture, household, and radio stores in 1939 sold goods to a total value of $138,992,000. There was one such store to every 2,467 people and average sales were $34,644 per store.

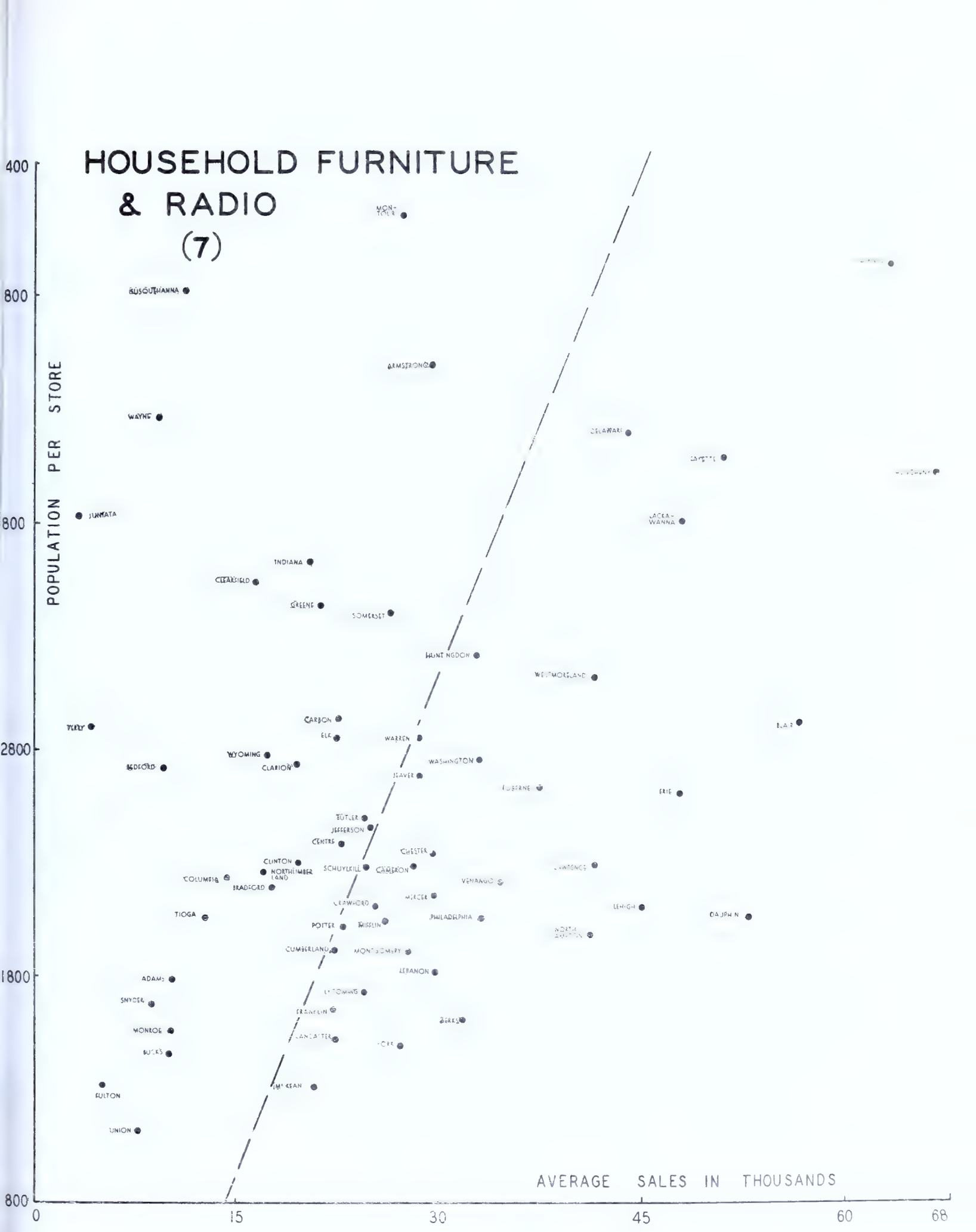

HOUSEHOLD FURNITURE & RADIO (7)
POPULATION PER STORE
400
800
1800
2800
800
AVERAGE SALES IN THOUSANDS
0
15
30
45
60
68
MONTOUR
SUSQUEHANNA
ARMSTRONG
WAYNE
DELAWARE
LAFAYETTE
JUNIATA
LACKAWANNA
INDIANA
CLEARFIELD
GREENE
SOMERSET
HUNTINGDON
WESTMORELAND
PERRY
CARBON
BLAIR
ELK
WARREN
WYOMING
BEDFORD
CLARION
WASHINGTON
BEAVER
ERIE
BUTLER
JEFFERSON
CENTRE
CHESTER
CLINTON
SCHUYLKILL
CAMERON
LAWRENCE
COLUMBIA
NORTHUMBERLAND
VENANGO
BRADFORD
MERCER
CRAWFORD
LEHIGH
TIOGA
PHILADELPHIA
DAUPHIN
POTTER
MIFFLIN
NORTHAMPTON
CUMBERLAND
MONTGOMERY
LEBANON
ADAMS
LYCOMING
SNYDER
FRANKLIN
BERKS
MONROE
LANCASTER
YORK
BUCKS
MCKEAN
FULTON
UNION

Chart No. 8

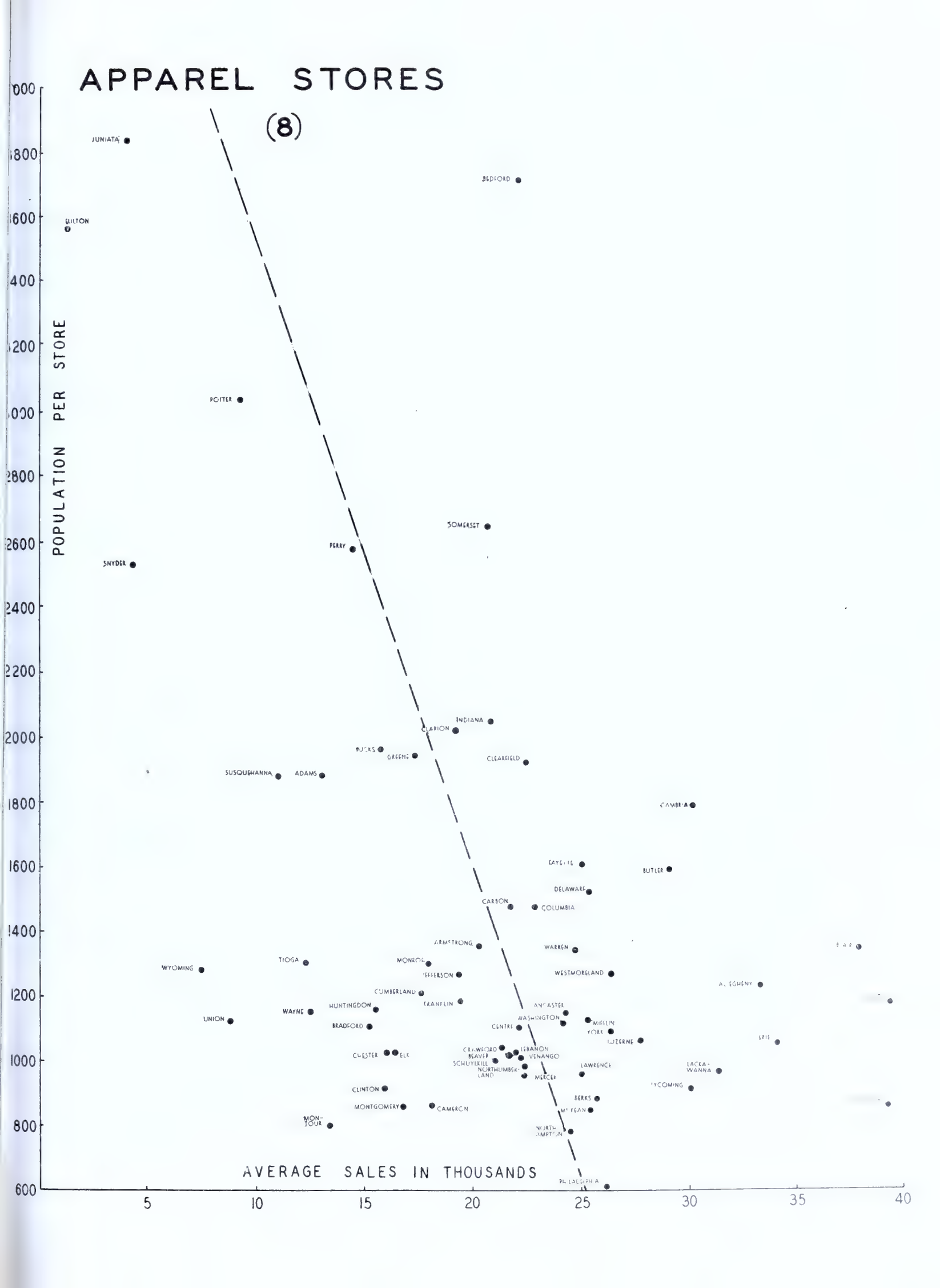
Apparel

At the time of the last Census slightly more than 10,000 stores in the Commonwealth specialized in the selling of apparel, which included clothing, hats, hosiery, and many other items. This does not include department stores dealing in general merchandise. There was approximately one apparel store to every 990 people. The average sales per store in this class of establishment was $26,100.

A glance at the chart illustrating the distribution of apparel stores shows a quite different picture from that prevailing in the food industry and in most lines of retail trade. Stores specializing in apparel in rural counties are likely to be extremely few, but sales also tend to be unusually low, so that the fewer the number of apparel stores in a county area the lower the sales are likely to be, which is quite contrary to a normal expectation.

The obvious reason for this type of distribution is the fact that in rural areas people are likely to buy many if not most articles of apparel from mail-order houses, or from general stores, or to purchase such goods in the larger cities of other counties. This peculiarity of apparel merchandising is undoubtedly due, in part, to the style factor in the design of clothes. A small rural establishment in a county of scattered population cannot hope to carry so large a stock of dresses, suits, hats, or shoes as a store in a larger community whose people are normally more clothes-conscious than they are in remote districts.

For these reasons location of an apparel store on the ground of a lack of such stores in the area would not be a safe speculation without considering other factors.


APPAREL STORES
(8)
POPULATION PER STORE
AVERAGE SALES IN THOUSANDS
JUNIATA
BEDFORD
FULTON
POTTER
SOMERSET
PERRY
SNYDER
INDIANA
CLARION
BUCKS
GREENE
CLEARFIELD
SUSQUEHANNA
ADAMS
CAMBRIA
BUTLER
DELAWARE
CARBON
COLUMBIA
ARMSTRONG
WARREN
WYOMING
TIOGA
MONROE
JEFFERSON
WESTMORELAND
ALLEGHENY
CUMBERLAND
FRANKLIN
LANCASTER
HUNTINGDON
WAYNE
UNION
WASHINGTON
MIFFLIN
BRADFORD
CENTRE
YORK
LUZERNE
ERIE
CHESTER
CRAWFORD
LEBANON
BEAVER
VENANGO
SCHUYLKILL
NORTHUMBERLAND
LAWRENCE
LACKAWANNA
MERCER
CLINTON
LYCOMING
BERKS
MONTGOMERY
CAMERON
MONTOUR
NORTHAMPTON
PHILADELPHIA
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
5
10
15
20
25
30
35
40

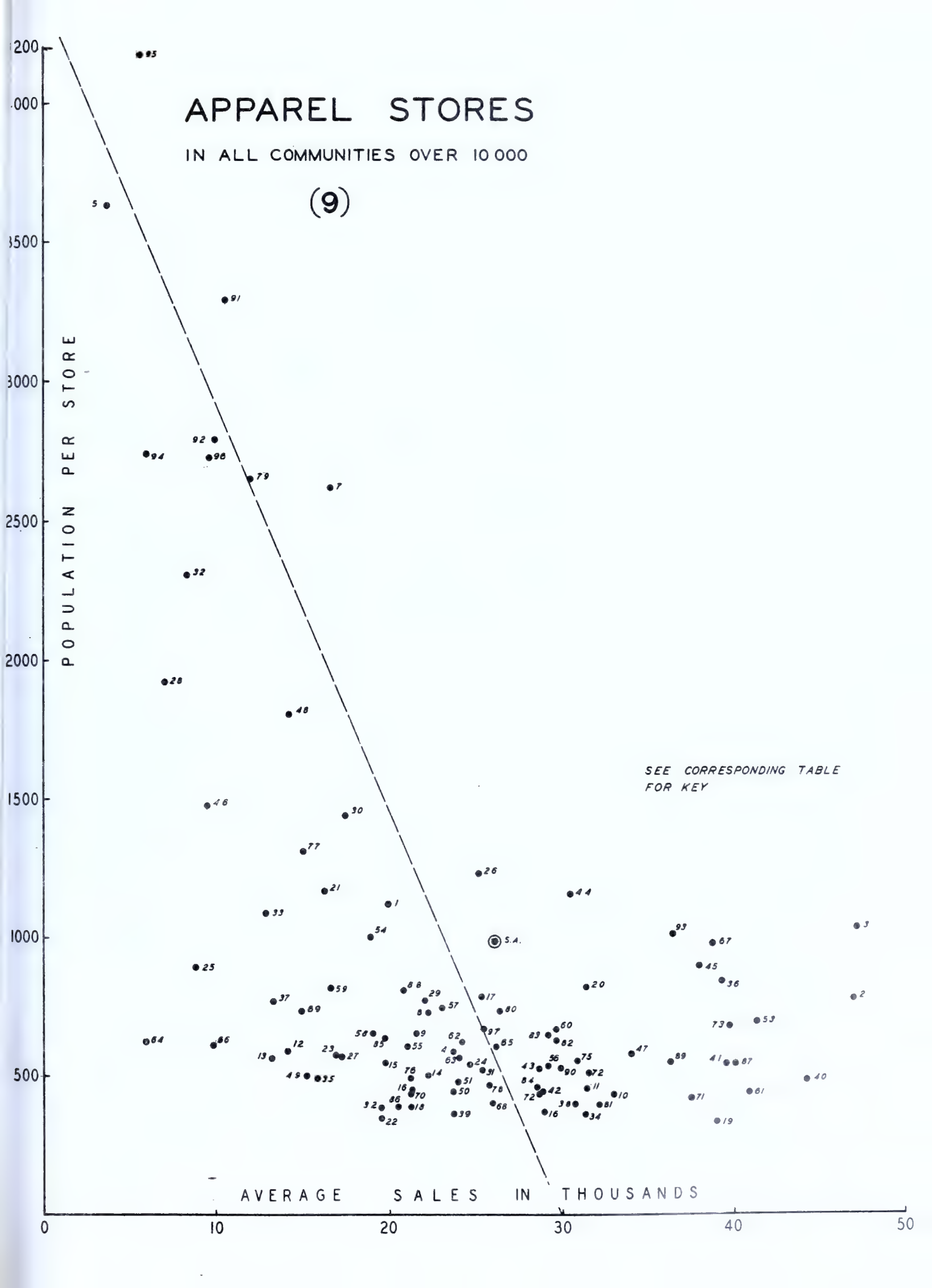

APPAREL STORES
IN ALL COMMUNITIES OVER 10 000
(9)
POPULATION PER STORE
AVERAGE SALES IN THOUSANDS
SEE CORRESPONDING TABLE FOR KEY
S.A.
0
10
20
30
40
50
500
1000
1500
2000
2500
3000
3500
4000

Chart No. 10

Automotive Group

Trends shown in the furniture and radio stores are greatly exaggerated in the pattern of the distribution of sales by stores dealing in automobiles and automotive supplies. The median line inclines very sharply to the right, which indicates that the number of possible customers per store is usually a very important factor in sales volume. The variation in sales per store is far more extreme than in any other retail group, and it is evident that competitive conditions and cost of operation tend to reduce the relative number of automotive stores in larger and more urbanized counties -- Philadelphia having the fewest stores per thousand people, Allegheny the second fewest.

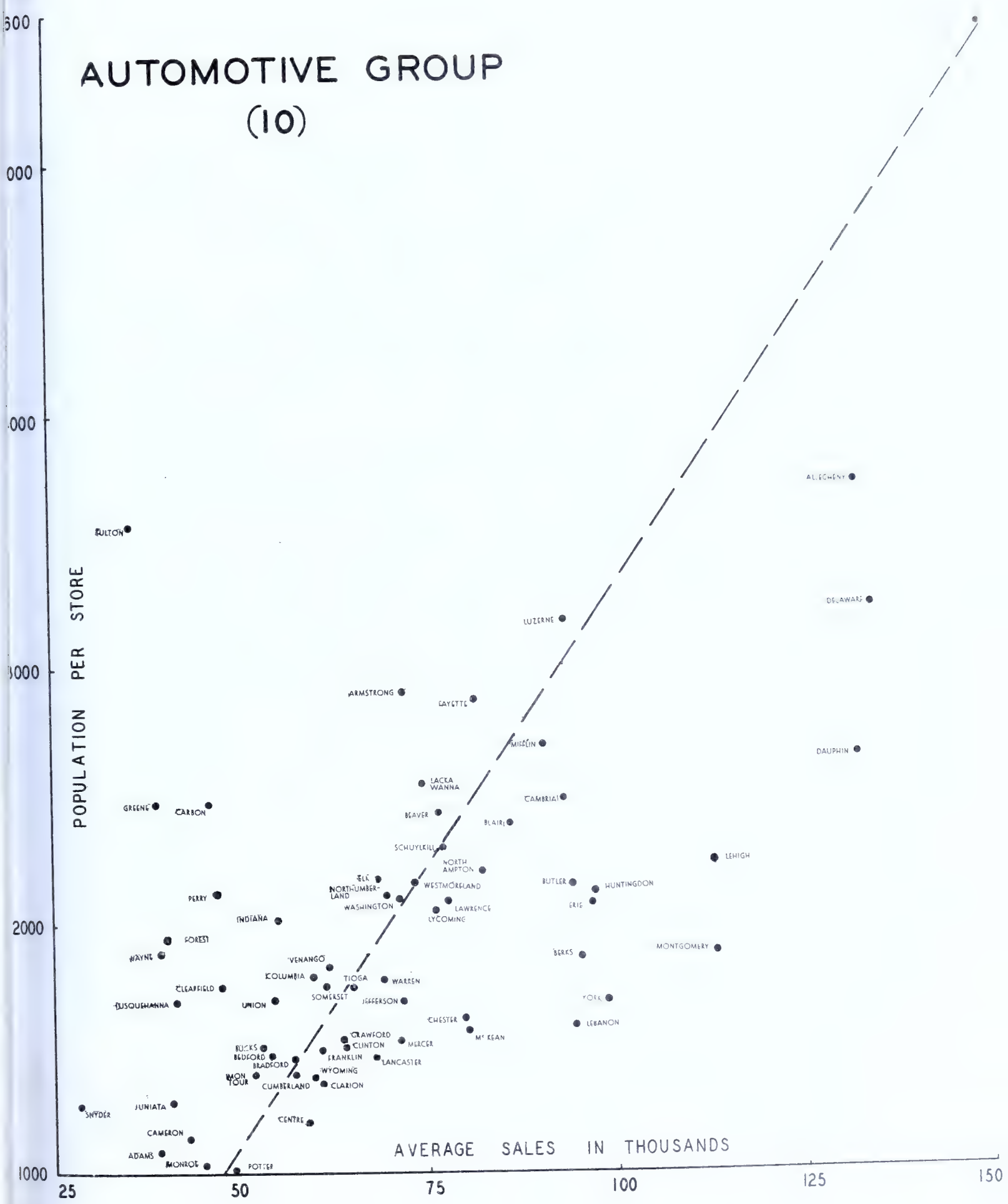
Motor cars are far more necessary in rural communities than in large cities, and that fact is shown by their low distribution per capita in such metropolitan areas as Philadelphia (1 car for every 7.40 people;) Lackawanna (1 car for every 7.08 people;) Luzerne (1 car for every 6.8 people;) Allegheny (1 car for every 5.63 people;) as compared with Pike County (1 car for every 3.24 people;) Monroe County (1 car for every 3.31 people;) Wyoming County (1 car for every 3.49 people).

There is consequently an apparently greater inducement for the location of automotive establishments in the towns and cities of predominantly rural areas. But average sales per store in rural counties of scattered population are well below the State average. The population per automotive store in such counties is likely to be below the average and competition, therefore, unusually keen. Thus Forest, Perry, Adams, Monroe,

and Potter have approximately five times as many automotive stores in proportion to the population as the city of Philadelphia, but sales per store are only 1/3 to 1/5 as high.

The factors bearing on sales volume in the automotive industry are somewhat complex. As our chart reveals there is a general relationship between the number of people per store and the sales per store, despite the fact that there are more cars per hundred people in the rural areas. The more expensive type of car purchased in large cities and the predominance of new cars over old cars in urban areas results in a fairly close agreement between population density and sales per store and also between the number of income tax returns and such sales.

In Chart No. 10 it will be seen that Philadelphia, Allegheny, Delaware, Daupin, Lehigh, and Montgomery Counties record the highest sales per establishment despite the great variation among those counties in the population per automotive store. These are all urban or well-to-do suburban areas where demand for new cars is unusually high. To the left of the chart where average sales are lowest are a group of rural counties of more or less scattered population.


AUTOMOTIVE GROUP
(10)
POPULATION PER STORE
AVERAGE SALES IN THOUSANDS
500
000
000
000
2000
1000
25
50
75
100
125
150
FULTON
GREENE
CARBON
PERRY
FOREST
WAYNE
CLEARFIELD
SUSQUEHANNA
INDIANA
UNION
SNYDER
JUNIATA
CAMERON
ADAMS
MONROE
POTTER
CENTRE
CUMBERLAND
CLARION
MON
TOUR
WYOMING
BRADFORD
BEDFORD
BUCKS
FRANKLIN
CLINTON
CRAWFORD
MERCER
LANCASTER
VENANGO
COLUMBIA
TIOGA
WARREN
SOMERSET
JEFFERSON
CHESTER
Mc KEAN
ELK
NORTH-
UMBER-
LAND
WASHINGTON
WESTMORELAND
LYCOMING
LAWRENCE
SCHUYLKILL
NORTH
AMPTON
LACKA
WANNA
ARMSTRONG
FAYETTE
MIFFLIN
LUZERNE
CAMBRIA
BEAVER
BLAIR
BUTLER
ERIE
HUNTINGDON
LEHIGH
DAUPHIN
DELAWARE
ALLEGHENY
BERKS
MONTGOMERY
YORK
LEBANON

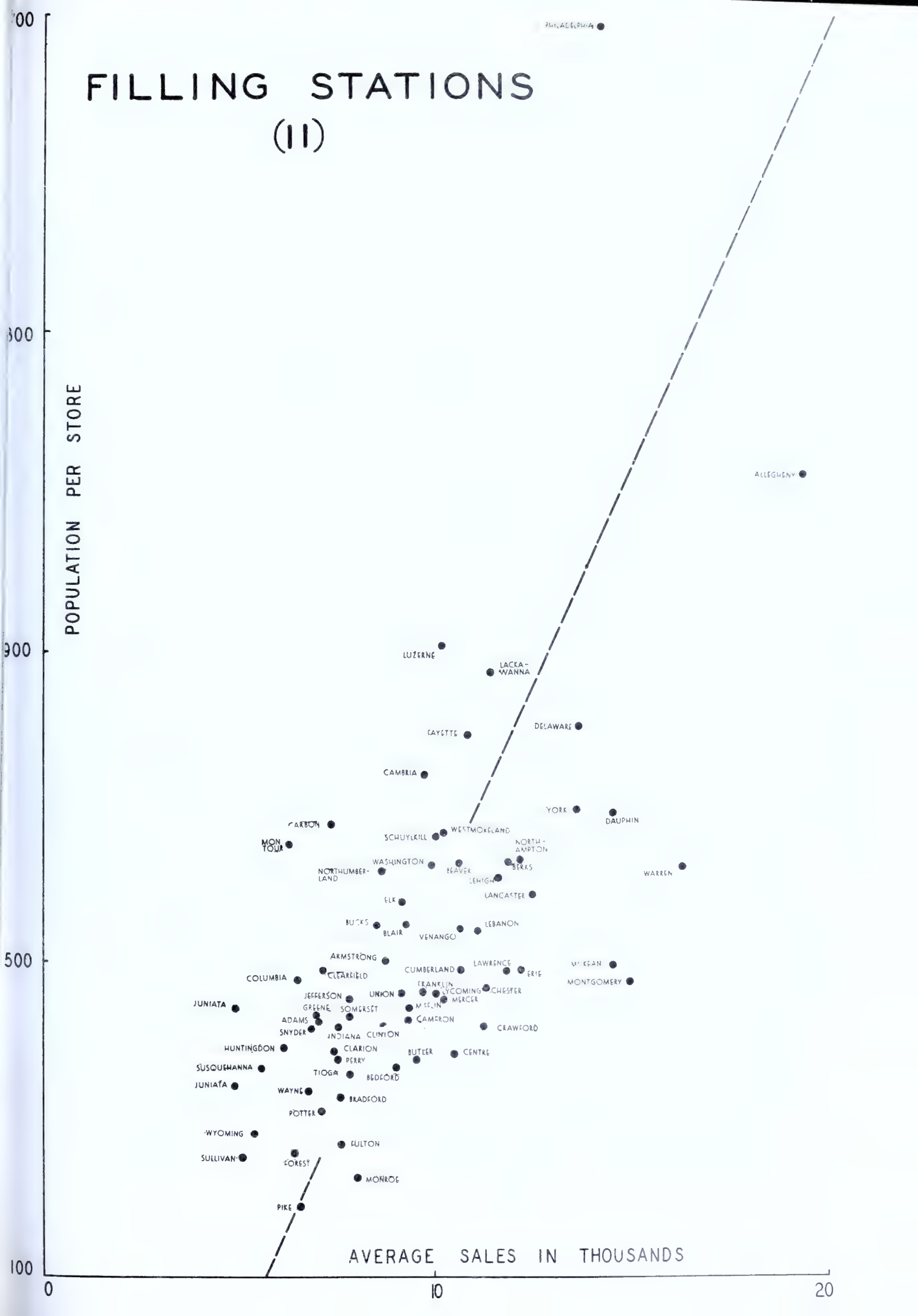

FILLING STATIONS
(11)
POPULATION PER STORE
AVERAGE SALES IN THOUSANDS
700
600
500
400
300
100
0
10
20
PHILADELPHIA
ALLEGHENY
LUZERNE
LACKA-
WANNA
DELAWARE
CAYSTTE
CAMBRIA
YORK
DAUPHIN
CARBON
SCHUYLKILL
WESTMORELAND
MON-
TOUR
NORTH-
AMPTON
WASHINGTON
BERKS
NORTHUMBER-
LAND
BEAVER
LEHIGH
WARREN
LANCASTER
ELK
BUCKS
BLAIR
VENANGO
LEBANON
ARMSTRONG
CUMBERLAND
LAWRENCE
ERIE
MCKEAN
COLUMBIA
CLEARFIELD
MONTGOMERY
CRANKLIN
LYCOMING
CHESTER
JEFFERSON
UNION
MERCER
JUNIATA
GREENE
SOMERSET
CAMERON
ADAMS
CRAWFORD
SNYDER
INDIANA
CLINTON
HUNTINGDON
CLARION
BUTLER
CENTRE
PERRY
SUSQUEHANNA
TIOGA
BEDFORD
JUNIATA
WAYNE
BRADFORD
POTTER
WYOMING
FULTON
SULLIVAN
FOREST
MONROE
PIKE

Chart No. 12

Drug Stores

The average sales for Pennsylvania drug stores is $23,500. There is one drug store for every 2,225 people. Total sales in 1939 were $104,392,000 in 4,450 stores. A considerable variation exists in the distribution among the counties. Greene County, for instance, has one store for every 5,580 people, while in the city of Philadelphia there was one store to every 1,310 people, though the sales per store in the State's largest city were below the average.

Counties such as Montgomery, Delaware, and Dauphin with a relatively large number of drug stores and a high income level show comparatively high sales per store. Counties with a scattered or largely rural population tend to have low sales and few stores per thousand people. The highest average sales per store were recorded in Lehigh County where curiously enough was established the first drug store in the history of the Commonwealth. It is not likely that the distribution of drug stores would be affected so greatly by income level, if the modern pharmacy had not also often become a purveyor of cosmetics, candies, soft drinks, magazines and miscellaneous novelties.

The considerable scattering shown on this chart reveals that the number of people per store is of comparatively small importance in determining average sales in the drug business. Factors of income and community buying habits are far more decisive.

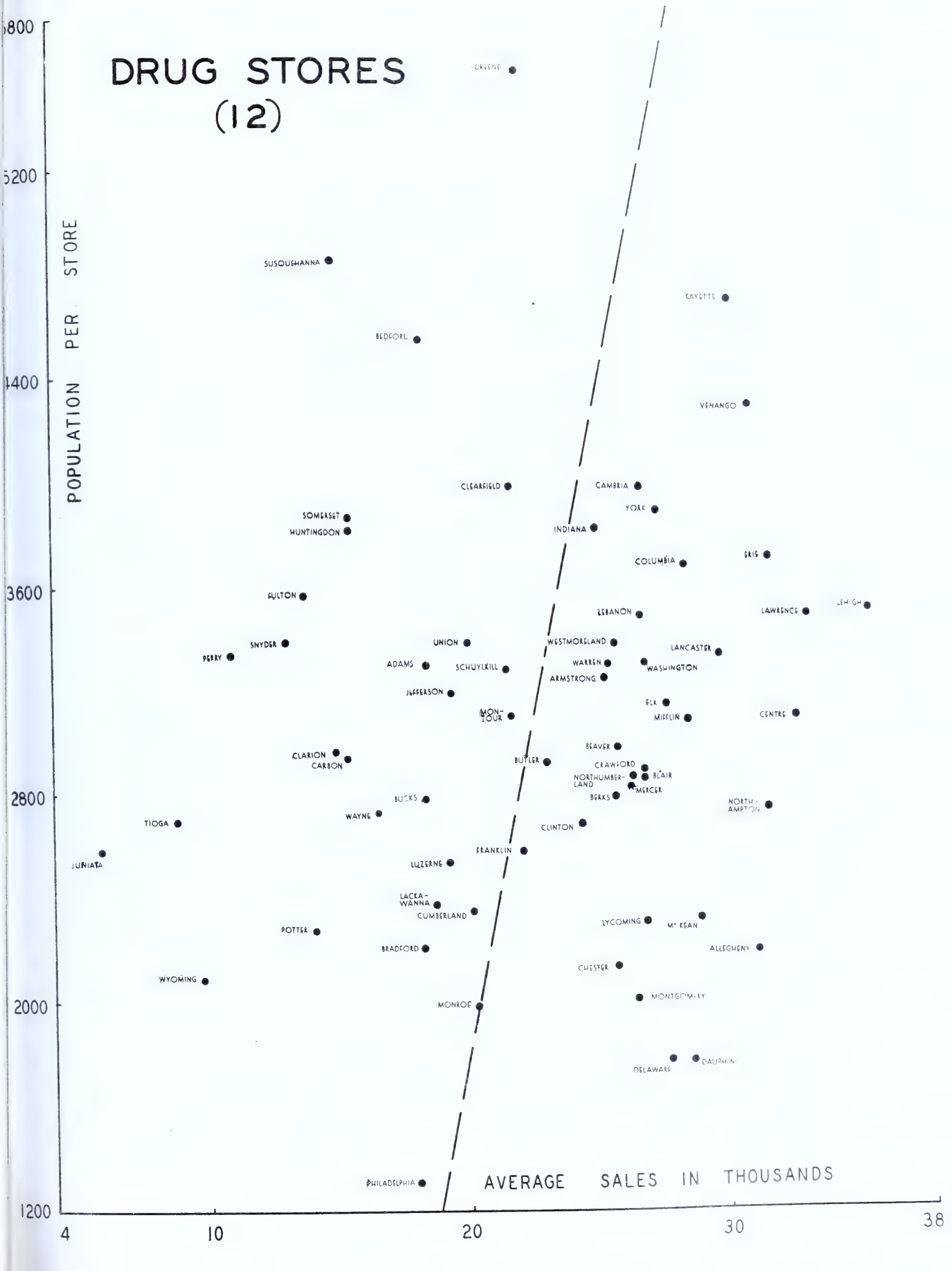

DRUG STORES
(12)
POPULATION PER STORE
5800
5200
4400
3600
2800
2000
1200
AVERAGE SALES IN THOUSANDS
4
10
20
30
38
GREENE
SUSQUEHANNA
FAYETTE
BEDFORD
VENANGO
CLEARFIELD
CAMBRIA
YORK
SOMERSET
HUNTINGDON
INDIANA
COLUMBIA
ERIE
FULTON
LEBANON
LAWRENCE
LEHIGH
SNYDER
UNION
WESTMORELAND
LANCASTER
PERRY
ADAMS
SCHUYLKILL
WARREN
WASHINGTON
ARMSTRONG
JEFFERSON
ELK
MIFFLIN
CENTRE
MONTOUR
BEAVER
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CRAWFORD
NORTHUMBERLAND
BLAIR
MERCER
BERKS
BUCKS
NORTHAMPTON
WAYNE
TIOGA
CLINTON
FRANKLIN
JUNIATA
LUZERNE
LACKAWANNA
CUMBERLAND
LYCOMING
McKEAN
POTTER
BRADFORD
ALLEGHENY
CHESTER
WYOMING
MONTGOMERY
MONROE
DELAWARE
DAUPHIN
PHILADELPHIA

Chart No. 13

Service Establishments

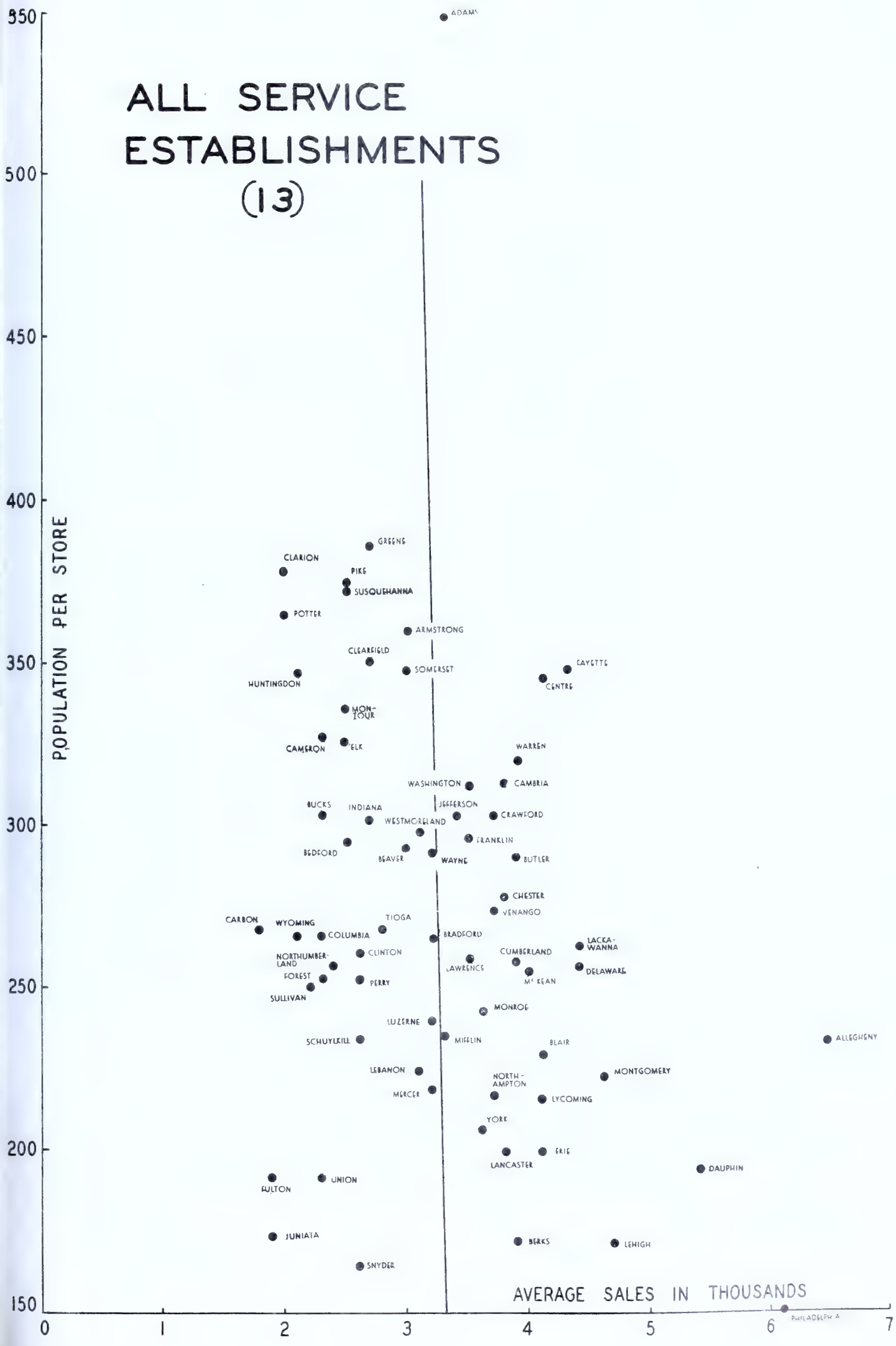
Under this general classification are included all types of establishments providing personal service; business service; transportation service; automotive repair and paint shops; other repair shops; custom industries including woodworking, small printing plants, custom and other manufacturing establishments whose products are valued at less than $5000; and miscellaneous services, including such widely diverse enterprises as circulating libraries, tree surgeons, landscape gardeners, and livery stables.

There were 45,149 such establishments in Pennsylvania whose total receipts were $213,100,000. Average sales per establishment were $4,700 and median sales $3,200. There was one such establishment for every 219 people.

Distribution as shown by the accompanying table and chart follows the pattern already seen in the apparel industries. In counties containing large cities and with relatively dense population, the number of service establishments tends to be high per capita and the sales also are above the State average.

In rural areas the number of service shops per thousand people is likely to be low and annual receipts below State average.

The complex development of the service industries in the past fifty years has been largely an urban phenomenon. The larger the city, the greater the variety of service establishments, and the greater the opportunity for success for new types of service.


ALL SERVICE ESTABLISHMENTS (13)
POPULATION PER STORE
AVERAGE SALES IN THOUSANDS
350
500
450
400
350
300
250
200
150
0
1
2
3
4
5
6
7
ADAMS
GREENE
CLARION
PIKE
SUSQUEHANNA
POTTER
ARMSTRONG
CLEARFIELD
SOMERSET
FAYETTE
HUNTINGDON
CENTRE
MONTOUR
CAMERON
ELK
WARREN
WASHINGTON
CAMBRIA
BUCKS
INDIANA
JEFFERSON
CRAWFORD
WESTMORELAND
FRANKLIN
BEDFORD
BEAVER
WAYNE
BUTLER
CHESTER
VENANGO
CARBON
WYOMING
TIOGA
COLUMBIA
BRADFORD
LACKAWANNA
CLINTON
CUMBERLAND
NORTHUMBERLAND
LAWRENCE
DELAWARE
FOREST
PERRY
Mc KEAN
SULLIVAN
MONROE
LUZERNE
SCHUYLKILL
MIFFLIN
BLAIR
ALLEGHENY
LEBANON
MONTGOMERY
NORTHAMPTON
MERCER
LYCOMING
YORK
ERIE
LANCASTER
DAUPHIN
FULTON
UNION
JUNIATA
BERKS
LEHIGH
SNYDER
PHILADELPHIA

In distinctly rural areas automobile repair shops, farm equipment repair shops, grist mills and perhaps blacksmith shops are likely to be the only forms of services available. In a large city, advertising agencies, blueprinting and photostat laboratories, public stenographic agencies, dental laboratories, photo finishers, typewriter repair shops, and similar establishments are needed and provide profitable employment. Small cities and country towns with their barber shops, beauty parlors, radio repair shops, circulating libraries, watch repair shops, printing establishments and the like represent a considerable increase in the complexity of services over rural areas and are tending more and more toward the development of types of service available in the larger cities.

Demand for services is growing and has lately been stimulated by the obsolescence of much existing domestic and business equipment and by the lack of manufactured goods for which war workers could spend their wages. Since employment in the service industries has shown a steady rise over the past 40 years, the long-range prospects are good, but it would be inadvisable to attempt to develop highly specialized types of services except in the larger cities where a demand already exists. In small communities skilled workers who are able to combine several types of allied services in a single establishment have frequently been very successful. A thorough canvass of local needs might well reveal the possibility of providing a group of such allied services -- no one of which might support an independent establishment in a small town or rural neighborhood.

As a suggestion as to the variety of such opportunities, we are listing the principal types of service establishments and custom industries for which data is collected by the United States Census:

Adjustment and credit bureaus, and collection agencies
Advertising Agencies
Armature rewinding shops
Auctioneers' establishments
Automobile laundries
Automobile paint shops
Automobile radiator shops
Automobile rental services
Automobile repair shops(general)
Automobile storage garages
Automobile top and body repair shops
Barber Shops
Barber and beauty shops
Baths and masseurs' establishments(Turkish, etc.)
Battery and ignition repair shops
Beauty parlors
Bicycle repair shops
Billboard advertising services
Blacksmith shops
Blueprinting and photostat laboratories
Circulating libraries
Cleaning, dyeing,pressing, alteration, and repair shops
Cleaning and dyeing plants
Coin-operated machine rental and repair service
Court reporting and public stenographic agencies
Dental laboratories
Disinfecting and exterminating services
Duplicating, addressing, mailing and mailing list services
Electrical appliance repair shops
Employment agencies
Funeral directors, embalmers, and crematories
Fur repair and storage shops
Harness and leather goods repair shops
Landscape gardening and tree surgery services
Laundries, hand
Laundries, power
Linen supply services without laundry facilities
Livery stables
Locksmith and gunsmith shops
Musical instrument repair shops
Parking lots
Photo finishing laboratories
Photographic studios
Piano and organ tuning and repair services
Radio repair shops
Refrigerator service and repair shops
Rug cleaning establishments
Saw and tool sharpening and repair shops
Shoe repair shops
Shoe shine parlors
Cleaning and renovating hats
Sign painting shops
Tire repair shops
Travel Bureaus(including ticket agents and brokers)
Typewriter repair shops
Upholstery and furniture repair shops
Warehousing
Watch, clock and jewelry repair shops
Window cleaning services

Custom Industries

Cabinetmaking shops(including woodworking)
Cider mills and presses
Grist mills
Hemstitching, embroidering and buttonholing shops
Machine shops
Mattress renovating and repair shops
Printing and publishing shops
Saw mills and planing mills(including contract logging)
Tinsmith shops
Welding shops

COMPARATIVE COUNTY DATA

Counties	1940 Population	1941 Income Tax Returns	1944 Passenger Car Registration	1944-1945 Time Bank and Postal Savings Deposits
Adams	39,435	2,406	9,202	$ 14,354,830
Allegheny	1,411,539	401,958	220,347	450,759,745
Armstrong	81,087	15,121	14,788	17,603,635
Beaver	156,754	41,332	25,798	30,338,432
Bedford	40,809	2,483	7,723	6,509,252
Berks	241,884	51,586	49,130	53,421,757
Blair	140,358	26,572	23,497	15,845,930
Bradford	50,615	7,295	9,530	13,911,391
Bucks	107,715	18,718	25,962	32,193,662
Butler	87,590	16,742	18,403	18,579,802
Cambria	213,459	43,307	31,220	29,547,730
Cameron	6,852	1,842	1,150	1,980,604
Carbon	61,735	11,967	9,695	18,709,954
Centre	52,608	7,577	10,188	9,358,083
Chester	135,626	24,888	29,084	40,546,332
Clarion	38,410	8,800	9,202	13,490,006
Clearfield	92,094	10,849	14,131	16,447,659
Clinton	34,557	5,582	6,080	7,584,886
Columbia	51,413	9,308	10,680	17,448,584
Crawford	71,644	14,461	16,431	15,135,552
Cumberland	74,806	14,145	17,910	16,769,372
Dauphin	177,410	43,365	34,342	44,444,915
Delaware	310,756	116,303	65,069	40,878,371
Elk	34,443	6,410	5,578	6,500,650
Erie	180,889	40,855	38,943	45,197,173
Fayette	200,999	32,388	28,426	18,012,706
Forest	5,791	700	1,150	816,261
Franklin	69,378	10,022	14,295	16,725,433
Fulton	10,673	285	1,972	2,006,947
Greene	44,671	5,648	7,066	4,203,322
Huntingdon	41,836	3,793	7,394	5,615,688
Indiana	79,854	11,047	13,967	15,537,357
Jefferson	54,090	6,179	9,202	8,246,454
Juniata	15,373	947	3,451	4,425,692
Lackawanna	301,243	42,352	36,971	81,856,442
Lancaster	212,504	36,357	45,351	54,837,811
Lawrence	96,877	22,442	18,896	20,276,310
Lebanon	72,641	12,965	15,939	21,550,310
Lehigh	177,533	36,889	30,563	44,067,330
Luzerne	441,518	63,668	56,139	138,482,348

Counties	1940 Population	1941 Income Tax Returns	1944 Passenger Car Registration	1944-1945 Time Bank and Postal Savings Deposits
Lycoming	93,633	18,370	19,389	$ 20,807,937
McKean	56,673	12,280	11,831	15,426,433
Mercer	101,039	25,052	20,539	35,950,372
Mifflin	42,993	7,543	7,230	6,942,972
Monroe	29,802	4,830	7,394	10,235,814
Montgomery	289,247	90,475	63,097	71,965,388
Montour	15,466	1,340	2,465	3,879,477
Northampton	168,959	48,601	35,656	68,347,331
Northumberland	126,887	16,566	19,225	26,501,731
Perry	23,213	2,203	5,094	5,683,389
Philadelphia	1,931,334	536,912	234,478	1,047,165,277
Pike	7,452	1,023	1,972	1,660,144
Potter	18,201	1,847	3,451	3,122,593
Schuylkill	228,331	27,514	33,520	59,532,732
Snyder	20,208	1,128	4,272	4,513,819
Somerset	84,957	10,381	14,295	14,800,533
Sullivan	7,504	576	1,315	1,512,818
Susquehanna	33,893	3,438	5,751	6,064,664
Tioga	35,004	4,578	7,558	6,713,288
Union	20,247	2,226	4,601	5,397,548
Venango	63,958	11,371	12,324	16,904,635
Warren	42,789	8,089	9,366	13,471,987
Washington	210,852	45,554	33,849	38,463,148
Wayne	29,934	3,236	5,587	12,944,492
Westmoreland	303,411	64,995	39,436	62,189,787
Wyoming	16,702	1,810	3,944	4,739,070
York	178,022	33,358	40,548	79,687,429
State Total	9,900,180	2,225,689	1,634,154	3,058,842,896

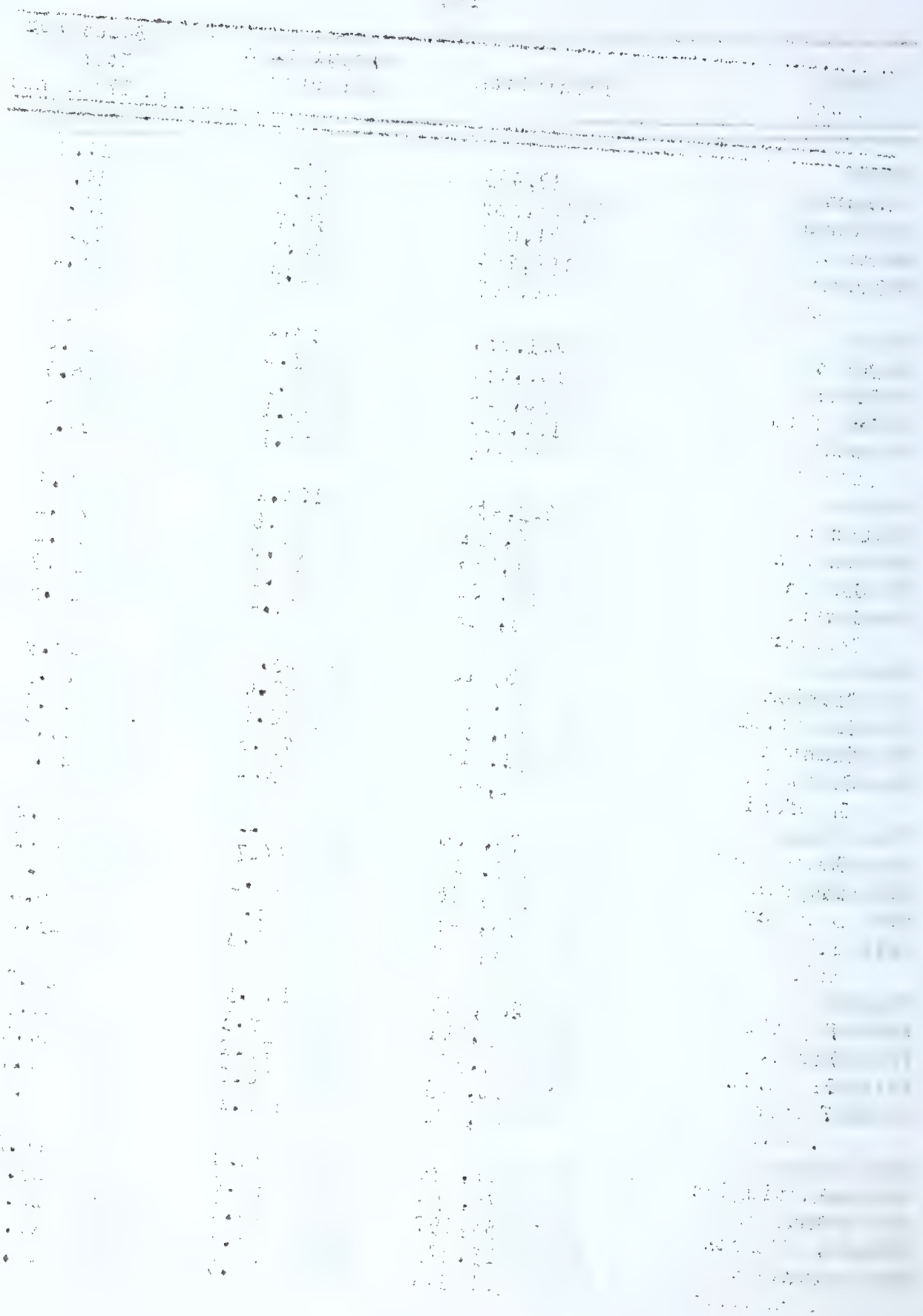
RH:G:es
Nov. 1945.

ALL RETAIL STORES

BY COUNTIES

1939

County	Population	Population Per Store	Sales Per Store In Thousands
Adams	39,435	73.7	$ 14.2
Allegheny	1,411,539	91.7	34.0
Armstrong	81,087	95.7	20.0
Beaver	156,754	86.8	23.6
Bedford	40,809	78.9	15.4
Berks	241,884	53.1	18.0
Blair	140,538	83.6	25.8
Bradford	50,615	66.3	16.9
Bucks	107,715	65.1	16.2
Butler	87,590	86.7	24.5
Cambria	213,459	101.2	28.4
Cameron	6,852	64.6	29.1
Carbon	61,735	67.0	13.1
Centre	52,608	77.3	22.2
Chester	135,626	72.4	22.5
Clarion	38,410	83.7	18.9
Clearfield	92,094	87.6	18.3
Clinton	34,557	70.0	18.1
Columbia	51,413	75.6	17.6
Crawford	71,644	73.1	22.4
Cumberland	74,806	72.1	19.8
Dauphin	177,410	66.7	25.2
Delaware	310,756	94.3	27.6
Elk	34,443	83.6	18.4
Erie	180,889	67.3	23.0
Fayette	200,999	110.5	26.7
Forest	5,791	79.3	12.5
Franklin	69,378	79.2	20.0
Fulton	10,673	60.0	7.1
Greene	44,671	106.1	18.4
Huntingdon	41,836	76.8	16.2
Indiana	79,854	92.0	19.9
Jefferson	54,090	89.0	21.1
Juniata	15,373	66.5	11.5
Lackawanna	301,243	71.9	19.7



County	Population	Population Per Store	Sales Per Store In Thousands
Lancaster	212,504	52.8	$ 18.0
Lawrence	96,877	74.8	22.9
Lebanon	72.641	64.6	19.8
Lehigh	177,533	63.0	22.7
Luzerne	441,518	70.3	17.7
Lycoming	93,633	67.8	21.0
McKean	56,673	73.9	24.2
Mercer	101,039	74.3	23.2
Mifflin	42,993	66.0	18.1
Monroe	29,802	44.3	16.4
Montgomery	289,247	69.5	24.8
Montour	15,466	89.4	16.0
Northampton	168,959	65.0	21.5
Northumberland	126,887	67.7	16.0
Perry	23,213	71.6	12.0
Philadelphia	1,931,334	64.2	25.5
Pike	7,452	45.2	9.8
Potter	18,201	65.2	17.2
Schuylkill	228,331	62.7	13.6
Snyder	20,208	72.2	9.9
Somerset	84,957	90.4	20.0
Sullivan	7,504	56.0	7.3
Susquehanna	33,893	70.6	13.5
Tioga	35,004	71.7	16.8
Union	20,247	63.9	12.7
Venango	63,958	91.6	24.8
Warren	42,789	90.5	25.9
Washington	210,852	86.3	22.9
Wayne	29,934	66.1	16.1
Westmoreland	303,411	91.0	22.5
Wyoming	16,702	57.6	15.3
York	178,022	75.8	23.5

RH:es
Nov., 1945.

ALL RETAIL STORES

1939

No.	Place	Population	Population Per Store	Sales Per Store In Thousands
1	Aliquippa	27,023	90.4	$ 28.0
2	Allentown	96,904	61.5	30.9
3	Altoona	80,214	80.7	32.2
4	Ambridge	18,968	68.5	28.4
5	Arnold	10,898	122.4	19.3
6	Beaver Falls	17,098	51.0	29.9
7	Bellevue	10,488	138.0	47.2
8	Berwick	13,181	72.8	21.8
9	Bethlehem	58,490	65.1	24.2
10	Braddock	18,326	51.0	31.0
11	Bradford	17,691	60.4	34.7
12	Bristol	11,895	51.9	15.8
13	Butler	24,477	61.2	41.1
14	Canonsburg	12,599	62.7	23.7
15	Carbondale	19,371	61.1	20.7
16	Carlisle	13,984	54.0	28.6
17	Carnegie	12,663	62.1	27.7
18	Chambersburg	14,852	50.2	27.5
19	Charleroi	10,784	51.8	36.7
20	Chester	59,285	59.5	26.4
21	Clairton	16,381	83.2	22.1
22	Coatesville	14,006	48.1	27.1
23	Columbia	11,547	34.2	9.2
24	Connellsville	13,608	56.7	29.5
25	Conshohocken	10,776	65.7	15.0
26	Coraopolis	11,086	88.0	31.2
27	Darby	10,334	74.3	33.9
28	Dickson City	11,548	85.5	11.7
29	Donora	13,180	67.9	21.5
30	Dormont	12,974	119.0	46.8
31	Du Bois	12,080	57.0	29.6
32	Dunmore	23,086	84.9	11.5
33	Duquesne	20,693	88.4	18.7
34	Easton	33,589	54.3	33.1
35	Ellwood City	12,329	63.2	28.1
36	Erie	116,955	65.2	26.9
37	Farrell	13,899	72.0	16.4
38	Greensburg	16,743	55.3	42.1
39	Hanover	13,076	48.3	26.5
40	Harrisburg	83,893	54.1	32.5

No.	Place	Population	Population Per Store	Sales Per Store In Thousands
41	Hazleton	38,009	62.8	$ 28.0
42	Homestead	19,041	53.5	28.6
43	Indiana	10,050	49.5	38.1
44	Jeannette	16,220	83.2	29.0
45	Johnstown	66,668	81.0	43.7
46	Kingston	20,679	72.3	26.4
47	Lancaster	61,345	45.7	26.6
48	Lansdowne	10,837	127.5	49.3
49	Latrobe	11,111	60.7	25.4
50	Lebanon	27,206	54.3	25.8
51	Lewistown	13,017	42.5	28.6
52	Lock Haven	10,810	53.3	29.3
53	Mc Keesport	55,355	75.9	37.4
54	Mc Kees Rocks	17.021	62.1	21.1
55	Mahanoy City	13,442	42.7	12.7
56	Meadville	18,919	61.8	38.1
57	Monessen	20,257	74.7	20.1
58	Mount Carmel	17,780	62.6	14.8
59	Munhall	13,900	201.4	31.5
60	Nanticoke	24,387	56.8	15.3
61	New Castle	47,638	61.5	27.2
62	New Kensington	24,055	71.6	38.4
63	Norristown	38,181	59.5	26.4
64	North Braddock	15,679	172.3	15.4
65	Oil City	30,379	72.3	34.6
66	Old Forge	11,892	67.6	10.3
67	Philadelphia	1,931,354	64.2	25.5
68	Phoenixville	12,282	62.0	20.7
69	Pittsburgh	671,659	85.3	42.8
70	Pittston	17,828	50.6	20.3
71	Plymouth	15,507	56.8	12.9
72	Pottstown	20,194	46.9	26.2
73	Pottsville	24,530	55.4	32.2
74	Reading	110,568	49.6	24.6
75	Scranton	140,404	68.8	27.6
76	Shamokin	18,810	50.3	23.6
77	Sharon	25,622	66.7	36.2
78	Shenandoah	19,790	47.7	15.8
79	Steelton	13,115	71.3	12.9
80	Sunbury	15,462	56.6	26.1
81	Swissvale	15,919	124.4	21.2
82	Tamaqua	12,486	55.0	17.7
83	Uniontown	21,819	53.3	46.5
84	Vandergrift	10,725	76.1	28.6
85	Warren	14,891	66.2	58.9

No.	Place	Population	Population Per Store	Sales Per Store In Thousands
86	Washington	26.166	55.4	$ 34.5
87	Waynesboro	10,231	63.5	25.6
88	West Chester	13,289	46.0	34.4
89	Wilkes Barre	86,236	57.8	27.8
90	Wilkinsburg	29,853	94.5	33.2
91	Williamsport	44,355	58.5	27.6
92	York	56.712	58.5	30.8
93	Harrison Twp.	13,161	140.0	17.0
94	Mt. Lebanon Twp.	19,571	181.2	47.1
95	Stowe Twp.	12,577	127.0	14.1
96	Upper Darby Twp.	56,883	104.2	45.5
97	Haverford Twp.	27,594	205.9	21.5
98	Hanover Twp.	16,439	73.1	5.8
99	Plains Twp.	15,621	95.8	8.4
100	Abbington Twp.	20,857	119.2	15.7
101	Cheltenham Twp.	19,082	149.1	33.2
102	Lower Merion Twp.	39,566	84.5	44.1

Note: Numbers as given in this list identify communities shown on charts 3, 5, and 9.

RH:G:es
Oct. 1945.

Counties	FOOD STORES		RESTAURANTS	
	Population Per Store	Sales Per Store In Thousands	Population Per Store	Sales Per Store In Thousands
Adams	268	$ 12.57	840	$ 11.8
Allegheny	225	22.71	1,120	18.9
Armstrong	288	18.31	1,530	8.1
Beaver	242	22.12	1,080	9.1
Bedford	312	12.60	910	10.8
Berks	130	11.86	730	10.0
Blair	217	21.20	1,180	10.1
Bradford	232	14.85	1,210	6.6
Bucks	201	14.91	640	9.7
Butler	295	21.46	1,250	9.6
Cambria	376	17.18	1,890	12.4
Cameron	221	21.42	380	8.1
Carbon	179	12.99	1,100	5.6
Centre	309	24.16	1,030	19.3
Chester	241	19.25	870	11.6
Clarion	302	20.01	1,370	8.1
Clearfield	244	16.64	1,510	6.8
Clinton	229	17.65	1,590	9.3
Columbia	227	14.91	1,050	6.6
Crawford	281	21.86	1,140	9.3
Cumberland	207	17.86	1,130	13.0
Dauphin	175	14.66	680	12.6
Delaware	255	24.38	1,320	17.3
Elk	248	19.37	2,460	7.5
Erie	174	14.84	880	10.9
Fayette	305	17.68	1,880	11.5
Forest	414	16.71	970	11.0
Franklin	248	15.45	1,050	8.6
Fulton	237	7.13	890	7.6
Greene	395	19.58	1,860	9.7
Huntingdon	231	14.52	850	5.6
Indiana	310	15.89	1,510	11.0
Jefferson	256	20.36	2,080	10.0
Juniata	192	9.98	850	5.7
Lackawanna	178	15.12	1,070	11.5
Lancaster	129	9.28	810	9.5
Lawrence	219	17.88	890	8.4
Lebanon	175	11.99	760	7.4
Lehigh	164	14.26	710	10.0
Luzerne	172	12.77	1,170	9.4

Counties	FOOD STORES		RESTAURANTS	
	Population Per Store	Sales Per Store In Thousands	Population Per Store	Sales Per Store In Thousands
Lycoming	208	$ 16.91	930	$ 10.5
McKean	243	23.79	940	12.4
Mercer	233	19.39	1,370	12.2
Mifflin	210	15.60	770	8.4
Monroe	213	20.39	320	6.8
Montgomery	199	21.46	860	11.4
Montour	292	16.81	2,210	5.0
Northampton	166	16.04	890	10.6
Northumberland	198	13.77	1,230	6.7
Perry	225	11.01	1,110	17.8
Philadelphia	159	14.84	800	18.5
Pike	186	14.00	250	6.3
Potter	268	16.21	1,010	4.5
Schuylkill	160	10.45	1,000	6.4
Snyder	285	10.00	960	6.0
Somerset	321	17.14	1,160	8.7
Sullivan	235	8.00	840	4.6
Susquehanna	219	15.17	1,210	7.0
Tioga	280	16.70	880	7.9
Union	311	18.46	650	4.9
Venango	263	21.98	1,560	12.8
Warren	289	23.08	1,300	15.0
Washington	226	17.58	1,420	9.0
Wayne	263	17.80	1,360	5.0
Westmoreland	235	17.51	1,310	10.0
Wyoming	239	15.13	600	6.2
York	216	15.19	860	9.1

RH:es
Nov. 1945.

Counties	HOUSEHOLD, FURNITURE & RADIO		HARDWARE STORES	
	Population Per Store	Sales Per Store In Thousands	Population Per Store	Sales Per Store In Thousands
Adams	1,790	$ 10.3	1,315	$ 17.1
Allegheny	4,030	66.3	2,823	39.7
Armstrong	4,500	29.2	2,192	32.3
Beaver	2,700	28.4	2,177	26.6
Bedford	2,720	9.5	1,511	19.1
Berks	1,610	31.8	2,122	32.7
Blair	2,930	56.2	2,159	20.5
Bradford	2,200	17.5	1,489	27.1
Bucks	1,480	9.9	1,632	34.6
Butler	2,500	24.4	1,788	35.8
Cambria	4,960	63.0	2,885	35.2
Cameron	2,280	28.0	1,370	47.2
Carbon	2,940	22.6	1,715	13.7
Centre	2,390	22.7	1,547	21.9
Chester	2,340	29.4	2,188	46.8
Clarion	2,740	19.3	1,280	21.7
Clearfield	3,540	16.4	1,616	21.7
Clinton	2,300	19.5	1,819	23.4
Columbia	2,240	14.2	1,658	27.0
Crawford	2,110	25.2	1,086	26.7
Cumberland	1,920	22.2	2,200	43.4
Dauphin	2,060	52.2	2,957	31.0
Delaware	4,200	43.8	2,988	45.1
Elk	2,870	22.3	2,296	14.8
Erie	2,620	47.6	1,791	28.3
Fayette	4,100	50.7	2,753	32.8
Forest	*	*	1,448	21.3
Franklin	1,650	22.1	1,779	34.2
Fulton	1,330	5.0	890	4.3
Greene	3,440	21.0	2,978	35.3
Huntingdon	3,220	32.5	1,902	17.2
Indiana	3,630	20.5	1,857	29.1
Jefferson	2,460	24.8	1,639	27.6
Juniata	3,840	3.5	1,183	25.1
Lackawanna	3,810	47.8	2,317	26.2
Lancaster	1,530	22.1	1,518	36.1
Lawrence	2,310	41.3	1,615	32.9
Lebanon	1,820	29.6	2,505	47.0
Lehigh	2,110	44.8	2,276	40.4
Luzerne	2,640	37.2	2,509	22.4

Counties	HOUSEHOLD, FURNITURE & RADIO		HARDWARE STORES	
	Population Per Store	Sales Per Store In Thousands	Population Per Store	Sales Per Store In Thousands
Lycoming	1,730	$ 24.4	1,951	$ 36.6
McKean	1,320	20.5	1,491	28.8
Mercer	2,150	29.5	1,347	28.2
Mifflin	2,050	25.9	1,303	19.7
Monroe	1,570	10.1	1,146	26.4
Montgomery	1,930	27.6	1,842	32.3
Montour	5,160	27.3	2,209	15.0
Northampton	1,990	40.9	2,522	33.3
Northumberland	2,270	16.9	1,606	21.0
Perry	2,900	4.1	1,222	14.8
Philadelphia	2,080	33.3	2,423	21.8
Pike	*	*	2,484	31.0
Potter	2,020	22.9	1,213	20.1
Schuylkill	2,280	24.7	1,903	19.7
Snyder	1,680	8.6	1,347	14.3
Somerset	3,400	26.4	1,734	26.7
Sullivan	*	*	834	7.4
Susquehanna	4,840	11.1	1,211	18.8
Tioga	2,060	12.8	1,094	17.4
Union	1,120	7.6	1,191	17.0
Venango	2,210	34.3	2,205	31.1
Warren	2,850	28.3	1,646	30.3
Washington	2,770	32.9	1,934	32.2
Wayne	4,280	9.4	1,663	48.8
Westmoreland	3,130	41.1	2,167	32.9
Wyoming	2,780	17.2	982	32.7
York	1,500	27.1	2,782	34.7

* Sales not given.

RH:es
Nov. 1945.

Counties	DRUG STORES		APPAREL STORES	
	Population Per Store	Sales Per Store In Thousands	Population Per Store	Sales Per Store In Thousands
Adams	3,290	$ 18.5	1,880	$ 13.0
Allegheny	2.190	31.0	1,230	32.7
Armstrong	3,240	25.2	1,350	20.2
Beaver	2,960	25.7	1,000	21.8
Bedford	4,530	18.2	3.710	22.0
Berks	2,780	25.7	880	25.7
Blair	2,860	26.8	1,340	37.8
Bradford	2,200	18.3	1,100	15.2
Bucks	2,760	18.2	1,960	15.7
Butler	2,920	23.0	1,590	29.0
Cambria	3,950	26.6	1,790	30.1
Cameron	*	*	860	18.1
Carbon	2,940	15.4	1,470	21.7
Centre	3,090	32.5	1,100	22.1
Chester	2,120	25.6	1,020	16.0
Clarion	2,950	14.9	2,020	19.2
Clearfield	3,960	21.6	1,920	22.4
Clinton	2,660	24.2	910	15.9
Columbia	3,670	28.3	1,470	22.8
Crawford	2,870	26.7	1,000	21.0
Cumberland	2,340	20.1	1,210	17.6
Dauphin	1,760	28.6	860	39.3
Delaware	1,710	27.7	1,520	25.3
Elk	3,130	27.6	1,010	16.1
Erie	3,690	31.5	1,050	34.0
Fayette	4,670	30.0	1,600	25.0
Forest	*	*	*	*
Franklin	2,570	22.0	1,180	19.4
Fulton	3,560	13.7	3,560	1.3
Greene	5,580	22.0	1,940	17.3
Huntingdon	3,800	15.5	1,160	15.5
Indiana	3,800	24.9	2,050	20.8
Jefferson	3,180	19.4	1,260	19.3
Juniata	2,560	5.8	3,840	4.0
Lackawanna	2,370	18.6	970	31.3
Lancaster	3,320	29.7	1,150	24.3
Lawrence	3,460	33.0	960	25.0
Lebanon	3,460	26.5	1,020	22.0
Lehigh	3,480	35.3	1,180	39.4
Luzerne	2,520	19.2	1,060	27.6

Counties	DRUG STORES		APPAREL STORES	
	Population Per Store	Sales Per Store In Thousands	Population Per Store	Sales Per Store In Thousands
Lycoming	2,280	$ 26.7	910	$ 30.0
McKean	2,270	28.9	850	25.4
Mercer	2,810	26.3	950	22.3
Mifflin	3,070	28.4	1,130	25.3
Monroe	1,990	20.4	1,300	17.9
Montgomery	2,010	26.4	860	16.8
Montour	3,090	21.6	810	13.4
Northampton	2,730	31.5	780	24.5
Northumberland	2,820	26.4	980	22.3
Perry	3,320	10.9	2,580	14.4
Philadelphia	1,310	18.0	610	26.1
Pike	*	*	*	*
Potter	2,280	14.0	3,030	9.2
Schuylkill	3,260	21.5	1,000	20.9
Snyder	3,370	13.0	2,530	4.3
Somerset	3,860	15.5	2,650	20.6
Sullivan	*	*	*	*
Susquehanna	4,840	15.0	1,880	11.0
Tioga	2,690	8.8	1,300	12.3
Union	3,370	20.0	1,120	8.8
Venango	4,260	30.8	1,020	22.1
Warren	3,290	25.4	1,340	24.7
Washington	3,290	26.8	1,110	24.1
Wayne	2,720	16.5	1,150	12.3
Westmoreland	3,370	25.7	1,270	26.3
Wyoming	2,090	9.8	1,280	7.5
York	3,870	27.3	1,090	26.3

*Sales not given.

RH:es
Nov. 1945

Counties	FILLING STATIONS		AUTOMOTIVE GROUP	
	Population Per Store	Sales Per Store In Thousands	Population Per Store	Sales Per Store In Thousands
Adams	424	$ 7.0	1,070	$ 39.0
Alleghony	1,119	19.3	[illegible],730	132.7
Armstrong	501	8.7	2,900	73.3
Beaver	617	10.6	2,410	78.5
Bedford	364	9.0	1,460	54.2
Berks	623	11.9	1,850	95.[illegible]
Blair	548	9.3	2,380	85.9
Bradford	527	7.6	1,450	57.1
Bucks	544	8.5	1,500	5[illegible].2
Butler	378	9.5	2,140	[illegible]4.2
Cambria	739	9.7	[illegible],480	[illegible].6
Cameron	428	9.2	1,140	42.5
Carbon	677	7.3	2,470	46.4
Centre	381	10.5	1,200	59.2
Chester	461	11.3	1,610	79.9
Clarion	388	7.4	1,370	61.2
Clearfield	485	7.2	1,740	47.8
Clinton	416	8.7	1,500	64.1
Columbia	472	6.5	1,770	59.9
Crawford	412	11.2	1,5[illegible]0	[illegible].0
Cumberland	485	10.6	1,390	57.3
Dauphin	680	14.5	2,650	1[illegible].2
Delaware	799	13.6	3,240	1[illegible].5
Elk	574	9.1	2,150	68.[illegible]
Erie	486	12.1	2,060	96.5
Fayette	788	10.8	2,870	81.[illegible]
Forest	252	6.4	1,930	[illegible].7
Franklin	456	9.7	1,480	[illegible].8
Fulton	267	7.6	3,560	50.3
Greene	425	7.0	2,480	[illegible].2
Huntingdon	391	6.1	2,090	97.1
Indiana	414	7.5	2,000	55.4
Jefferson	455	7.8	1,690	71.[illegible]
Juniata	439	4.9	1,280	40.8
Lackawanna	858	11.4	2,530	74.9
Lancaster	584	12.4	1,460	87.9
Lawrence	480	11.8	2,060	78.[illegible]
Lebanon	538	11.1	1,580	94.5
Lehigh	604	11.6	2,220	112.7
Luzerne	897	10.2	3,180	9[illegible].4

Counties	FILLING STATIONS		AUTOMOTIVE GROUP	
	Population Per Store	Sales Per Store In Thousands	Population Per Store	Sales Per Store In Thousands
Lycoming	455	$ 10.0	2,040	$ 76.7
McKean	435	14.5	1,570	80.4
Mercer	451	10.2	1,510	71.1
Mifflin	430	9.4	2,690	90.4
Monroe	221	8.0	1,030	45.0
Montgomery	671	14.9	1,880	113.9
Montour	644	6.3	1,410	51.5
Northampton	638	12.1	2,220	82.2
Northumberland	616	8.6	2,110	69.6
Perry	374	7.5	1,110	47.8
Philadelphia	1,681	14.1	5,520	149.4
Pike	136	6.3	*	*
Potter	308	7.1	1,010	49.2
Schuylkill	656	10.3	2,280	77.3
Snyder	421	6.9	1,260	29.1
Somerset	429	7.8	1,750	81.5
Sullivan	259	5.1	*	*
Susquehanna	381	5.6	1,690	41.6
Tioga	384	7.8	1,750	85.3
Union	450	9.1	1,690	54.1
Venango	537	10.6	1,850	81.3
Warren	620	16.7	1,780	89.3
Washington	622	9.9	2,090	71.0
Wayne	329	6.8	1,870	39.6
Westmoreland	665	10.2	2,150	78.4
Wyoming	274	5.4	1,390	60.8
York	698	13.5	1,680	98.5

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ALL SERVICE ESTABLISHMENTS

BY COUNTIES

1939

Counties	Population Per Store	Sales Per Store In Thousands
Adams	548	$ 3.3
Allegheny	233	6.4
Armstrong	359	3.0
Beaver	292	3.0
Bedford	294	2.5
Berks	172	3.9
Blair	229	4.1
Bradford	264	3.2
Bucks	303	2.3
Butler	289	3.9
Cambria	313	3.8
Cameron	326	2.3
Carbon	267	1.8
Centre	344	4.1
Chester	277	3.8
Calrion	377	2.0
Clearfield	350	2.7
Clinton	260	2.6
Columbia	265	2.3
Crawford	302	3.7
Cumberland	257	3.9
Dauphin	194	5.4
Delaware	256	4.4
Elk	325	2.5
Erie	200	4.1
Fayette	347	4.3
Forest	252	2.3
Franklin	295	3.5
Fulton	191	1.9
Greene	385	2.7
Huntingdon	346	2.1
Indiana	301	2.7
Jefferson	302	3.4
Juniata	173	1.9
Lackawanna	262	4.4
Lancaster	200	3.8
Lawrence	258	3.5
Lebanon	224	3.1
Lehigh	171	4.7
Luzerne	239	3.2

Counties	Population Per Store	Sales Per Store In Thousands
Lycoming	215	$ 4.1
McKean	254	4.0
Mercer	218	3.2
Mifflin	234	3.3
Monroe	242	3.6
Montgomery	222	4.6
Montour	335	2.5
Northampton	216	3.7
Northumberland	256	2.4
Perry	252	2.6
Philadelphia	150	6.1
Pike	373	2.5
Potter	364	2.0
Schuylkill	233	2.6
Snyder	164	2.6
Somerset	347	3.0
Sullivan	250	2.2
Susquehanna	372	2.5
Tioga	267	2.8
Union	191	2.3
Venango	273	3.7
Warren	319	3.9
Washington	311	3.5
Wayne	291	3.2
Westmoreland	297	3.1
Wyoming	265	2.1
York	206	3.6

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DEPARTMENT OF COMMERCE
STATE PLANNING BOARD



INDUSTRIAL UTILITY OF WATER IN PENNSYLVANIA

CHEMICAL CHARACTER OF SURFACE WATER

1944 TO 1946

PREPARED IN COOPERATION WITH
UNITED STATES GEOLOGICAL SURVEY
AND
PENNSYLVANIA DEPARTMENT OF
FORESTS & WATERS

PUBLICATION 17

AUGUST 1947

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▼

Research and Planning Associates

Fred H. Ott

Paul B. Gensemer

Robert H. Miller

Anne Mueller

Alice P. Brown

Mary A. Leonard

Industrial Utility of Water in Pennsylvania

Chemical Character of Surface Water

1944-1946

Prepared in cooperation with the
Pennsylvania Department of Forests and Waters
The Pennsylvania Post-War Planning Commission
and
The United States Geological Survey

Pennsylvania Department of Commerce
State Planning Board

August 1947

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INTRODUCTION AND ACKNOWLEDGMENTS

Tremendous quantities of water fall on Pennsylvania each year in the form of rain, snow, and hail. The amount varies from time to time and from place to place, so that floods and droughts may sometimes follow in quick succession. It has been estimated that in an average year 138 billion tons of water fall on Pennsylvania, 5000 tons per acre. How is this water utilized? Where does it go? What chemicals does it dissolve from the soil on which it falls? These are important questions. Knowledge of the characteristics, and availability of water in Pennsylvania is essential for the prosperity and well-being of all the industries and all the people in the State.

The Departments of Forests and Waters, Internal Affairs, Health, and other agencies are actively engaged in obtaining information about precipitation, stream flow, underground water streams, and the sanitary quality of the State's water. Recognizing the need of industry for adequate and reliable data on the chemical quality of water in Pennsylvania streams, the Pennsylvania Department of Commerce through its State Planning Board entered into a cooperative agreement in 1944 with the United States Geological Survey for the purpose of obtaining systematic records of the chemical characteristics of surface waters throughout the State.

This report is a summary of the first results of that study. It presents chemical analyses of water samples collected during the period July 1944, through September 1946, as part of the program to determine the industrial quality of Pennsylvania surface waters. It also deals with the factors which affect the chemical character of surface waters, with the significance of mineral constituents in water and with their effect on industrial use.

The State Planning Board wishes to acknowledge the invaluable assistance of John W. Mangan, Chief of the Division of Hydrography of the Department of Forests and Waters, and District Engineer of the United States Geological Survey, who has aided greatly in coordinating the State and Federal activities involved in this cooperative study. The water analyses were made in the Geological Survey laboratory in Washington, D. C., W. D. Collins, chemist in charge, Quality of Water Division. The work in Pennsylvania is under the direct supervision of Walter F. White, Jr., of the Geological Survey.

This program of research and the publication of its results have been made possible by the contributions and sponsorship of the Pennsylvania Department of Forests and Waters, the Pennsylvania Post-War Planning Commission, the Pennsylvania State Planning Board of the Department of Commerce, and the United States Geological Survey.

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INDUSTRIAL USE OF WATER IN PENNSYLVANIA

Water is essential for the existence of man. Without water in sufficient quantity and of suitable quality the farms, cities, and great industries of Pennsylvania could not prosper. Fully aware of the importance of water for its well being, the Commonwealth is vigorously pursuing a policy of collecting and interpreting basic facts about its surface and ground waters as a necessary step toward improving waters that have become polluted, and safeguarding the future of this vital resource.

Pennsylvania's waters are used for domestic, industrial, recreational, and many other purposes. Use of water for drinking, washing, cooking, growing of crops, boating, swimming, etc., is known to all. Such uses are so common that one tends to overlook the tremendous volume of water they require. It is also not generally realized what variety of uses are made of water by the State's industries, and what quantities of water are required for their operations.

The importance of water to industry is discussed in a report by the National Resources Planning Board.[1] In that report the industrial uses of water are classified as follows: For transportation of materials, for power, for raw material, for steam generation, for condensing and cooling, for washing and cleaning, for processing, for waste treatment and disposal, and for fire protection.

[1] Industrial location and National resources: Nat'l Res. Plan. Bd., chap. 8, pp. 181-185, December 1942.

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TABLE A. Industrial requirements for water *

Product	*Unit*	*Water required, gal. to produce one unit*
Airplane engines	1 Engine	50,000 - 125,000
Alcohol	Gallon	100
Aluminum	Pound	160
Brewing (beer)	1 barrel	470
Butadiene	Pound	160
Canning	100 cases No. 2 cans	2,500 - 25,000
Cement	Ton	750
Coke	Ton	3,600
Distilling:		
Grain	1,000 bu. grain mashed	600,000
Molasses	1,000 gal., 100-proof	8,400
Cooling water	1,000 gal., 100-proof	120,000
Electric power	Kilowatt	80
Gasoline	Gallon	7 - 10
Iron ore (brown ore)	Ton	1,000
Meat, slaughterhouse and packing	100 hogs killed	550
Milk	1,000 raw pounds	100 - 300
Oil refining	Barrel	770
Paper	Ton	5,000 - 85,000
Rail freight	Ton/mile	0.1
Soap	Ton	500
Steam power	Ton of coal	60,000 - 120,000
Tanning	100 lbs. rawhide	800
Textiles	1,000 lbs. processed	1,000 - 20,000
Rayon	1,000 lbs. produced	135,000 - 160,000
Woolens	1,000 lbs. finished	70,000

* Data reported in Journal of American Water Works Association, Vol. 38, No. 1, January 1946.

Table A contains general information about the quantities of water that may be required for the output of certain products in which Pennsylvania, in many instances, leads the Nation.

A recent investigation made by the Western Pennsylvania Coal Operators Association indicated, for instance, that approximately 60 gallons of water are required for each ton of bituminous coal mined. This estimate is based upon water requirements of 50 mines producing 30,000,000 tons of coal per year.

Adequate knowledge of the availability of water is of primary importance to industry. Equally important for appraisal of the suitability of water for many industrial purposes is a knowledge of its chemical composition. Water from streams, lakes, wells or springs may contain in solution, or in suspension some portion of nearly anything with which it has come in contact. Information about the source and significance of the constituents of water has been given in a previous report,[2] but for convenience is included in this report on pages 15 to 19.

Many industries have specific requirements with reference to chemical quality of water that must be met either by natural water or by treatment of whatever supply is available. Limits of tolerance for chemical quality of water for some industries are given in table B. The limits serve merely to indicate certain characteristics of water that significantly enter into an evaluation of the suitability of water for certain industrial processes. It is generally recognized that limits of impurities in acceptable industrial water supplies are affected by variations in processes and by the desired quality of the manufactured product. Values reported in the table are suggested only as guides in establishing the suitability of a water as measured by practices generally prevailing at the time the data were collected. In general, the

[2] Industrial Utility of Water, Part 1: U. S. Geol. Survey and Pa. Dept. of Forests and Waters, Pennsylvania State Planning Board, Pub. 14, June 1945.

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TABLE B. Suggested limits of tolerance for chemical quality of water for industrial use [a]
(Limiting values reported in parts per million)

Industry or use	*Color*	*Hardness as $CaCO_3$*	*Iron as Fe*	*Allowable manganese as Mn*	*Total solids*	*Alkalinity as $CaCO_3$*	*Other requirements* [b]
Baking	10	——	[c]0.2	0.2	——	——	P
Brewing, light beer	——	——	[c].1	.1	500	75	P. NaCl less than 275 p.p.m. (pH 6.5-7.0)
dark beer	——	——	[c].1	.1	1,000	150	P. NaCl less than 275 p.p.m. (pH 7.0 or more)
Canning, legumes	——	25-75	[c].2	.2	——	——	P
general	——	——	[c].2	.2	——	——	P
Carbonated beverages	10	250	.2 ([c].3)	.2	850	50-100	P. Organic color plus oxygen consumed less than 10 p.p.m.
Cooling	——	50	[c].5	.5	——	——	No corrosiveness
Food, general	——	——	[c].2	.2	——	——	P
Ice	5	——	[c].2	.2	——	——	P. SiO_2 less than 10 p.p.m.
Laundering	——	50	[c].2	.2	——	——	
Paper and pulp, groundwood	20	180	[c]1.0	.5	——	——	No grit, corrosiveness.
Kraft pulp	15	100	[c].2	.1	300	——	
soda and sulfite	10	100	[c].1	.05	200	——	
high-grade papers	5	50	[c].1	.05	200	——	
Rayon (Viscose), pulp production	5	8	[c].05	.03	100	total 50 hydroxide 8	Al_2O_3 less than 8 p.p.m. SiO_2 less than 25 p.p.m.
manufacture	——	55	.0	.0	——	——	pH 7.8 to 8.3.
Tanning	10-100	50-135	[c].2	.2	——	total 135 hydroxide 8	
Textiles, general	20	——	.25	.25	——	——	
dyeing	5-20	——	[c].25	.25	200	——	Constant composition.

[a] Data taken from a progress report by E. W. Moore; New England Water Works Assoc., Vol. 54, p. 263, 1940.
[b] P indicates that potable water, conforming to U.S.P.H.S. standards, is necessary.
[c] Limit given applies to both iron alone, and the sum of iron and manganese.

limits of impurities specified are those beyond which special corrective treatment of the water begins to be necessary. With the methods that have been developed in recent years for treating water, nearly any water can be "tailor made" for a particular industrial use if the economics of the situation justify such measures.

Chemical analyses of water for industrial purposes are necessary to determine whether water is suitable for specific purposes and, if not suitable, to determine what type of treatment is needed to make it satisfactory and what the cost of such treatment will be. Determination of the industrial utility of water, therefore, is largely a matter of interpreting correctly information made available through chemical analysis of representative samples. However, collection of a sample to represent a body of water and evaluation of the degree of representativeness are two of the most difficult problems associated with determination of the chemical character of a source of water.

Experience has shown that some sources of ground water and large bodies of surface water, such as Lake Erie, change very little in chemical quality over a period of years, and for all practical purposes the analysis of a sample of water collected from one of these sources may be representative of practically the entire source of water for many years. Determination of the industrial utility of such waters over a period of time may involve the analysis of only a few samples and may, therefore, be fairly simple and inexpensive.

Determination of the industrial utility of water in streams, however, is not so simple. Due to the very nature of occurrence of surface waters, it is inevitable that variations in chemical characteristics of streams should arise from time to time and from place to place. Because the major source of water for industrial use in Pennsylvania is the water that flows in the numerous streams within the Commonwealth, it is essential that the investigation of the industrial utility of these waters be so designed as to produce adequate and reliable data about the chemical characteristics of the surface waters.

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THE CHEMICAL QUALITY OF SURFACE WATERS DEPENDS UPON MANY FACTORS OF VARYING RELATIVE EFFECTS

PRECIPITATION
RAIN SNOW SLEET HAIL

FALLS UPON THE LAND IN VARIABLE AMOUNTS AND INTENSITIES WHERE IT MAY BE

RETAINED IN THE TOP SOIL

STORED IN UNDERGROUND STRATA OF SAND, GRAVEL AND POROUS ROCK

OR RUN OFF DIRECTLY TO THE STREAMS

RETAINED ON THE GROUND AS OPEN WATER, SNOW & ICE

FACTORS AFFECTING THE WATER ARE

GEOLOGY
PHYSICAL & CHEMICAL COMPOSITION OF SOILS, ROCKS, GRAVELS, SANDS AND MINERALS

HUMAN ACTIVITIES
DIVERSION, STORAGE, USE AND RETURN OF WATER. WASTE DISCHARGES. MINING, AGRICULTURE & OTHER LAND USES.

TOPOGRAPHY
SURFACE RELIEF
ELEVATION
SLOPE
STREAM PATTERN

CLIMATE & SEASON
TEMPERATURE
SUNLIGHT
WIND
BAROMETRIC PRESSURE

VEGETATION
KIND AND AMOUNT OF VEGETATION AND HUMUS COVERING

NATURE REMOVES SOME OF THE WATER BY

EVAPORATION AND TRANSPIRATION

THE REMAINDER EVENTUALLY FINDS ITS WAY TO THE STREAMS AND RIVERS AS

SURFACE WATER
CONTAINING: MINERALS DISSOLVED FROM THE EARTH, SILT AND PARTICLES IN SUSPENSION, PLANT AND ANIMAL LIFE, HUMAN AND INDUSTRIAL WASTES.

FACTORS AFFECTING CHEMICAL QUALITY OF SURFACE WATERS

There are many factors which affect in some degree the chemical quality of water in Pennsylvania's streams. Some relate to natural conditions such as precipitation, topographic and geologic features, and vegetation. Others result from human activities in connection with diversion, use, or return of water. Some affect the water-runoff pattern which in turn regulates the distribution of water from different sources; others contribute chemicals or soluble matter. One factor may be predominant in its effect in one part of a drainage basin and be insignificant in another part of the same basin. The influence of some factors varies with time and location, while the effect of others may be relatively constant.

The discharge of a stream is directly related to rainfall and other forms of precipitation. Variations in chemical quality of the stream water also are related to variations in precipitation, although not always in the same sequence or degree of response reflected by the stream flow. It has been observed many times that the chemical quality of water in some streams may remain unchanged even throughout relatively large changes in discharge, while the chemical quality of other streams may change with relatively small flow variations. Generally, one may expect lower concentrations of dissolved solids during periods of high than during periods of low water. Fundamentally, the amount and nature of material dissolved by water are functions of the solubility of the material and the length of time with which it is in contact with the water.

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Topographic features have much to do with the speed with which precipitation in different parts of a drainage basin may reach a main stream. Rainfall may occur in areas having steep gradients and be carried quickly to the main stream, while in other areas the ground may be nearly level, so that overland flow reaches the stream less rapidly. The same quantity and intensity of precipitation falling in each of these areas may have entirely different effects on variations in chemical quality of water in a stream. Vegetation, or the lack of vegetative cover, also influences the speed with which precipitation reaches a stream. Variations in the physical nature of geological features allow water to percolate at different rates to underground storage and thereby affect the surface runoff. Man may build dams or in other ways obstruct or alter the normal runoff pattern. Although these features within a given basin may remain practically unchanged, their effect on the concentration and chemical character of river water may differ from time to time because of the variation in distribution, intensity and amount of precipitation. They are usually of major importance with reference to the length of time in which opportunity is afforded for solution of earth materials with which the water is in contact.

Because the base flow of a stream consists largely of groundwater inflow, the quality of water in a stream tends to approach the quality of the inflow from ground-water sources during periods of little or no precipitation. Even though many of the factors that influence quality of surface waters also influence quality of ground waters, fluctuations in chemical content of sources of ground water do not ordinarily occur in the same magnitude as in surface waters. The process of collecting and mixing of water sources underground tends to smooth out the extremes in concentration and differences in chemical character much in the same manner as large reservoirs on streams tend to produce an outflow of water more constant in quality than the inflow. Because of longer and closer contact with geological formations, underground waters generally tend to

carry in solution greater quantities of soluble materials than are carried by surface runoff.

Through the operation of the above-mentioned factors and of many others, a normal pattern of variation in chemical quality of surface waters can be observed during periods of high or low rainfall. The quality of water in a stream during periods of no precipitation is affected by the proportion and quality of inflow from different ground-water sources. Surface runoff of precipitation tends to alter quickly the quality of this base flow by bringing in from different tributaries varying quantities of water of a quality characteristic of the area from which it comes. If in one area most of the factors mentioned have relatively the same effect as in other contributing areas, little change in quality of river water may be noted. If the factors in one area differ sharply in effect from those in nearby contributing areas marked changes in quality of river water are likely to occur.

In Pennsylvania, as in other states, there may be added to these natural factors others connected with human activities, such as use of streams for disposal of sewage and industrial waste material, diversion and use of water for many purposes, and the presence of acid water from mine drainage. The complex nature of the operation of all these factors is unique, in that a natural wide-range trend of variation in quantity and quality in response to precipitation can be predicted, yet variation within the trend may follow unpredictable courses. Interrelation of factors affecting runoff and quality of surface waters is indicated in the diagram on page 10.

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SOURCE AND SIGNIFICANCE OF CHEMICAL AND PHYSICAL CHARACTERISTICS OF NATURAL WATERS

Analyses of water are made for many purposes. A variety of chemical, physical, or bacteriological tests may be required in order to show whether a water is satisfactory for the purpose for which it is to be used. Analyses that are ordinarily made to determine whether a water is safe for human consumption do not always provide sufficient information for determining the industrial utility of the water. The characteristics and mineral constituents of natural waters here considered include those generally found to have practical effect on the value of the water for most industrial uses.

Color.—In water analysis the term "color" refers to the appearance of water that is free from suspended solids. Water for domestic use and some industrial uses should be free from perceptible color. Natural color in surface waters is caused almost entirely by organic matter extracted from plants and minerals. At many places, however, high color in water results from industrial wastes and sewage. A color less than 20 usually passes unnoticed. Some swamp waters have natural color of 200 or 300.

pH.—The intensity of acidity or alkalinity of a water, as indicated by the hydrogen-ion concentration, is of importance with reference to corrosive properties of water, and to proper treatment for coagulation at water-treatment plants. The symbol pH is commonly used to indicate the hydrogen-ion concentration. It represents the negative logarithm of the number of

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moles of ionized hydrogen per liter of water. A neutral water has a pH of 7.0. The pH of most natural waters varies between 6.0 and 8.0. Some alkaline waters have pH values greater than 8.0 and waters containing free mineral acid have values less than 4.5.

Specific conductance.—The specific conductance of a water is a measure of its ability to conduct a current of electricity. It varies with the concentration and degree of ionization of the different minerals in solution.

When considered in conjunction with results of determinations for other constituents, specific conductance plays an important part in revealing changes in concentration of the total dissolved minerals in surface waters.

Silica.—Silica is dissolved from practically all rocks. A few natural waters contain less than 3 parts per million of silica and some contain more than 50 parts, but most of them contain from 10 to 30 parts per million. Silica affects the usefulness of a water because it contributes to the formation of boiler scale.

Aluminum and manganese.—Aluminum and manganese are not regularly determined in the practical analysis of water. However, acid waters may have relatively large quantities of these constituents, which can be troublesome to certain users of the waters. Manganese is especially injurious in laundry work, and in textile processing that involves washing.

Iron.—Iron is dissolved from many rock materials. On exposure to the air, water that contains more than 1 part per million of iron soon becomes turbid with the insoluble compound produced by oxidation; surface waters rarely contain as much as 1 part per million of dissolved iron. Some acid waters, however, carry large quantities of iron in solution. Excessive iron causes stains on white porcelain, or enameled ware and fixtures and on clothing or other fabrics washed in the water. Iron is particularly troublesome in water used for many industrial purposes.

Calcium.—Calcium is dissolved from practically all rocks, but particularly from limestone, dolomite, and gypsum. Calcium and magnesium make water hard and are active agents in forming boiler scale. Most waters from granite contain less than 10 parts per million of calcium; many waters from limestone contain from 30 to 70 parts; and waters that leach deposits of gypsum may contain more than 100.

Magnesium.—Magnesium is dissolved from many rocks but particularly from dolomite. Its effects are similar to those of calcium, but waters that contain much magnesium and its chloride are likely to be corrosive, especially in steam boilers. The magnesium in soft waters may amount to only 1 or 2 parts per million, but water in areas that contain large quantities of dolomite may contain 20 to 50 parts per million.

Sodium and potassium.—Sodium and potassium are dissolved from practically all rocks, but they make up only a small part of the dissolved mineral matter in most waters in humid regions. Natural waters that contain only 3 or 4 parts per million of the two together are likely to carry about equal quantities of sodium and potassium. As the total quantity of these constituents increases, the proportion of sodium becomes greater. Moderate quantities of these constituents have little effect, but waters that carry more than 50 or 100 parts per million of the two may require careful operation of steam boilers to prevent foaming. Waters that contain large quantities of sodium salts injure crops and some waters contain so much sodium that they are unfit for nearly all uses.

Carbonate and bicarbonate.—Carbonate and bicarbonate occur in waters largely through the action of carbon dioxide, which enables the water to dissolve carbonates of calcium and magnesium. Carbonate is not present in appreciable quantities in many natural waters. The bicarbonate in waters that come from insoluble rocks may amount to less than 10 parts per million; many waters from limestone contain from 200 to

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400 parts per million; and certain waters that contain sodium bicarbonate may carry 1,000 or more parts of bicarbonate per million. The bicarbonate, as such, has comparatively little effect, although a large quantity may make water unsatisfactory for drinking and other domestic uses.

Sulfate.—Sulfate is dissolved in large quantities from gypsum and from deposits of sodium sulfate. It is also formed by the oxidation of sulfides of iron and is therefore present in considerable quantities in waters from mines and from many beds of shale. Sulfate in waters that contain much calcium and magnesium causes the formation of hard scale in steam boilers and may increase the cost of softening the water.

Chloride.—Chloride is dissolved in small quantities from rock materials in most parts of the country. The chloride in waters has little effect on their use unless it is present in excessive quantities, as in brines.

Fluoride.—Fluoride has been reported as present in rocks to about the same extent as chloride. However, the quantity present in natural waters is usually much less than that of chloride. Fluoride in water is known to be associated with the dental defect known as mottled enamel, if the water is used for drinking by young children during calcification or formation of the teeth. This condition becomes more noticeable as the quantity of fluoride in water increases above 1 part per million. It is reported that the incidence of dental caries (decay of teeth) is decreased or prevented by quantities of fluoride that are not sufficient to cause permanent disfigurement from mottled enamel.

Nitrate.—Nitrate in water is considered a final oxidation product of nitrogenous organic material. The quantities usually present have no effect on the value of water for ordinary use.

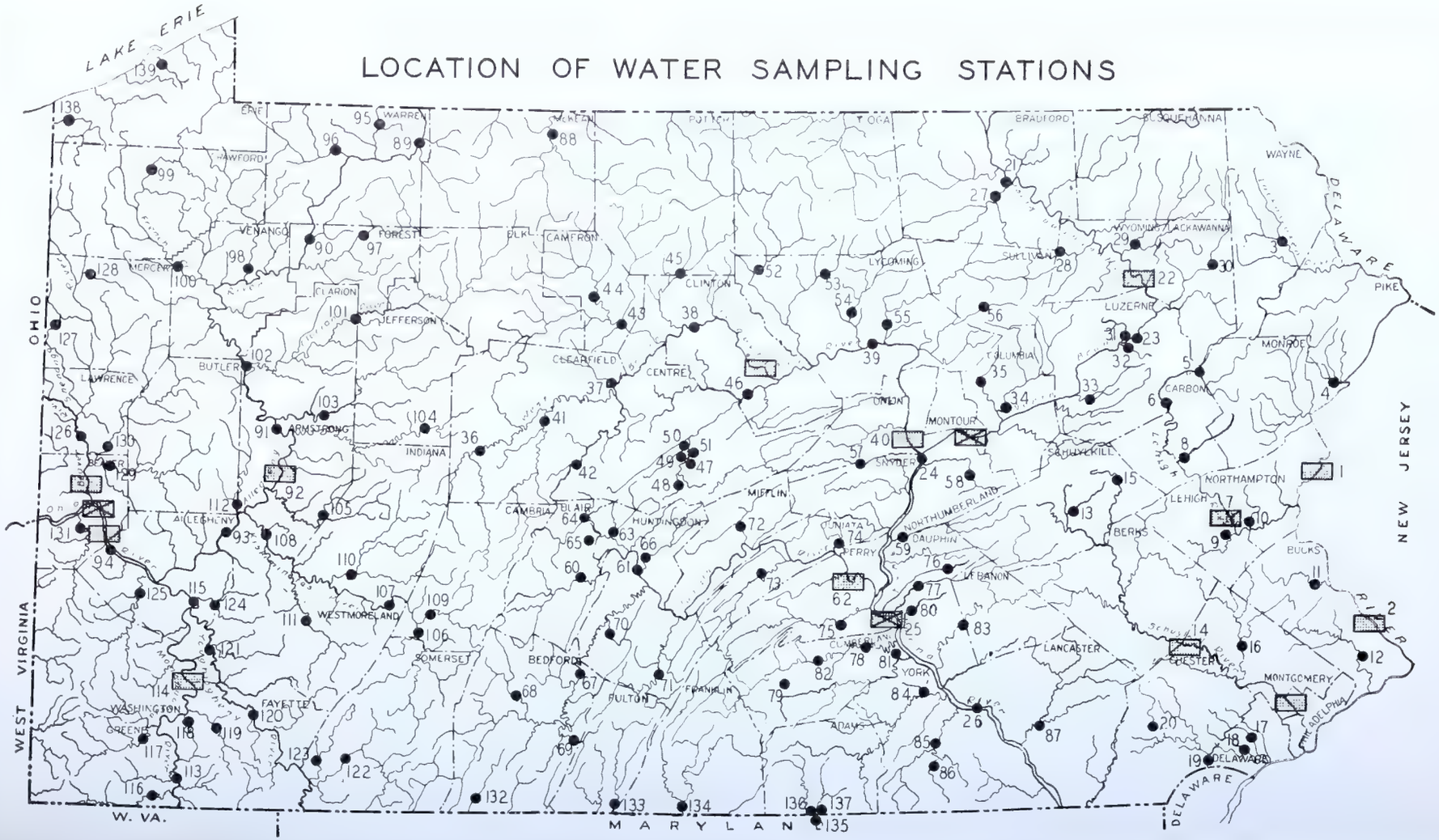
Dissolved solids.—The quantity reported as dissolved solids (the residue on evaporation) consists mainly of the dissolved mineral constituents in the water. It may also contain some

organic matter and water of crystallization. Waters with less than 500 parts per million of dissolved solids are usually satisfactory for domestic and most industrial uses. Waters with more than 1,000 parts per million of dissolved solids are likely to be unsuitable for most domestic and industrial uses.

Hardness.—Hardness is usually caused almost entirely by compounds of calcium and magnesium, although other constituents such as aluminum, iron, manganese, and free acid also may cause hardness. It is expressed as the quantity of calcium carbonate ($CaCO_3$) that is chemically equivalent to the calcium, magnesium, and other hardness-causing constituents.

Water that has less than 50 parts per million of hardness is usually rated as soft and its treatment for removal of hardness is seldom justified. Hardness between 50 and 150 parts per million does not seriously interfere with the use of water for many purposes, but its removal by softening processes may be profitable for laundries and other industries. Water with hardness beyond 150 parts per million usually requires some treatment for removal of hardness before being used. Hardness due to sulfate and other soluble salts of calcium and magnesium, such as chlorides or nitrates, is called noncarbonate hardness. In some instances it is more difficult and more expensive to remove noncarbonate from water than to remove carbonate hardness.

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LOCATION OF WATER SAMPLING STATIONS
LAKE ERIE
OHIO
WEST VIRGINIA
W. VA.
MARYLAND
DELAWARE
NEW JERSEY
ERIE
WARREN
MERCER
VENANGO
FOREST
CLARION
JEFFERSON
BUTLER
LAWRENCE
ARMSTRONG
INDIANA
CAMBRIA
BLAIR
CLEARFIELD
CENTRE
CLINTON
POTTER
TIOGA
BRADFORD
SUSQUEHANNA
WAYNE
LYCOMING
SULLIVAN
WYOMING
LACKAWANNA
LUZERNE
PIKE
MONROE
CARBON
NORTHAMPTON
LEHIGH
BUCKS
MONTOUR
COLUMBIA
SCHUYLKILL
BERKS
UNION
SNYDER
MIFFLIN
JUNIATA
PERRY
DAUPHIN
LEBANON
NORTHUMBERLAND
ALLEGHENY
WESTMORELAND
SOMERSET
BEDFORD
HUNTINGDON
FULTON
FRANKLIN
ADAMS
CUMBERLAND
YORK
LANCASTER
CHESTER
MONTGOMERY
DELAWARE
WASHINGTON
GREENE
FAYETTE
LOW FLOW-HIGH FLOW
DAILY SAMPLING

PLAN OF STUDY OF CHEMICAL CHARACTER OF SURFACE WATER

The many factors involved make determination of the chemical character of surface water a difficult and complicated process. A coordinated plan of study based on systematic collection of samples for chemical analysis must take into account the many and complicated effects of all these factors. Nearly any stream in the Commonwealth is a prospective source of water, but it is obviously not possible to collect continuous records of the quality of water at each point in a river basin at which it is thought the information might be of value. Neither is it economically feasible, at each sampling point, to collect data on all the physical, chemical, and bacteriological characteristics. It is, however, the purpose of this investigation to provide, economically, the essential data about the characteristic pattern of behavior of the chemical quality of surface waters in response to factors, natural and man-made, that affect the runoff of precipitation in Pennsylvania. Through systematic accumulation and study of such data on the volume and the chemical nature of water in its streams, Pennsylvania can use its surface waters to their fullest extent, equitably and efficiently.

The plan of study of industrial utility of surface waters in Pennsylvania is designed to furnish comprehensive analytical data at certain strategically located points within each large river system, and to provide means for making reliable estimates at other points. The study of each large river system calls for the establishment of a station for daily collection of samples near the lower end of the river system in order that the analyses may provide a continuous record of the overall effect of the many factors that influence the chemical character of the river water. With this record as a base, there can be built up within the basin an interlocking system of other daily sampling stations

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or of other sampling studies, that progressively aid one another in providing means for estimating the chemical character of surface water at nearly any place in the river system. It is expected that this plan of study will provide means for correlating and utilizing related analytical data obtained by other agencies or persons, in connection with their specialized activities.

The study has been divided into a number of phases relating to purposes for which water samples were collected for chemical analysis. The different phases are classified as follows:

1. Low-flow high-flow studies:

   Single samples of low-flow and high-flow are collected at many gaging stations in order to obtain State-wide information about variation of chemical quality with changes in discharge.

2. Daily sampling station studies:

   Water samples are collected daily from major streams in order to learn about the day to day changes in chemical character of the river water.

3. Cross-section studies:

   Samples are collected from time to time at several points across the width of a stream in order to have information about changes in chemical character of a river water from bank to bank.

4. Unit basin studies:

   Water samples are collected in a short period of time from numerous places within a selected river basin for the purpose of developing information about quality of water in most of the significant streams within the basin.

5. Miscellaneous studies:

   Water samples are collected from selected places as needed to supply additional information necessary to coordinate data obtained in other places.

In the following paragraphs each phase of study is discussed with reference to its particular objective and to its relationship with other phases. Illustrations typical of the analytical data obtained in each phase of study are given. The tables of analyses given at the end of this report are also grouped according to the different phases mentioned above.

Much of the value and effectiveness of the plan of study outlined here is dependent upon a proper balance between its different phases. Each phase is aided by the data obtained for other phases. Proper understanding and evaluation of the analytical records obtained at daily sampling stations are dependent in large part, on the data obtained in connection with unit basin studies. Interpretation of unit basin study data depends largely on records of discharge, and data obtained for the low-flow high-flow studies. Low-flow high-flow studies are more effective when aided by data collected for daily sampling studies. Cross-section studies are essential in instances where one sample alone cannot be considered representative of a river at the time of sampling.

The first year of investigation of the industrial utility of Pennsylvania's surface water was concerned with, (1) starting the collection of continuous records of chemical quality at 10 daily sampling stations and 1 cross-section sampling station, and (2) obtaining information such as produced by the low-flow high-flow studies. In the second year additional daily sampling stations and cross-section sampling stations were started, and the emphasis on data supporting the daily sampling studies was shifted from low-flow high-flow studies to unit basin studies.

Plans for continuation of the investigation include in particular the following:

1. Maintenance of a basic network of daily sampling station studies for use as reference points within the various river basins.

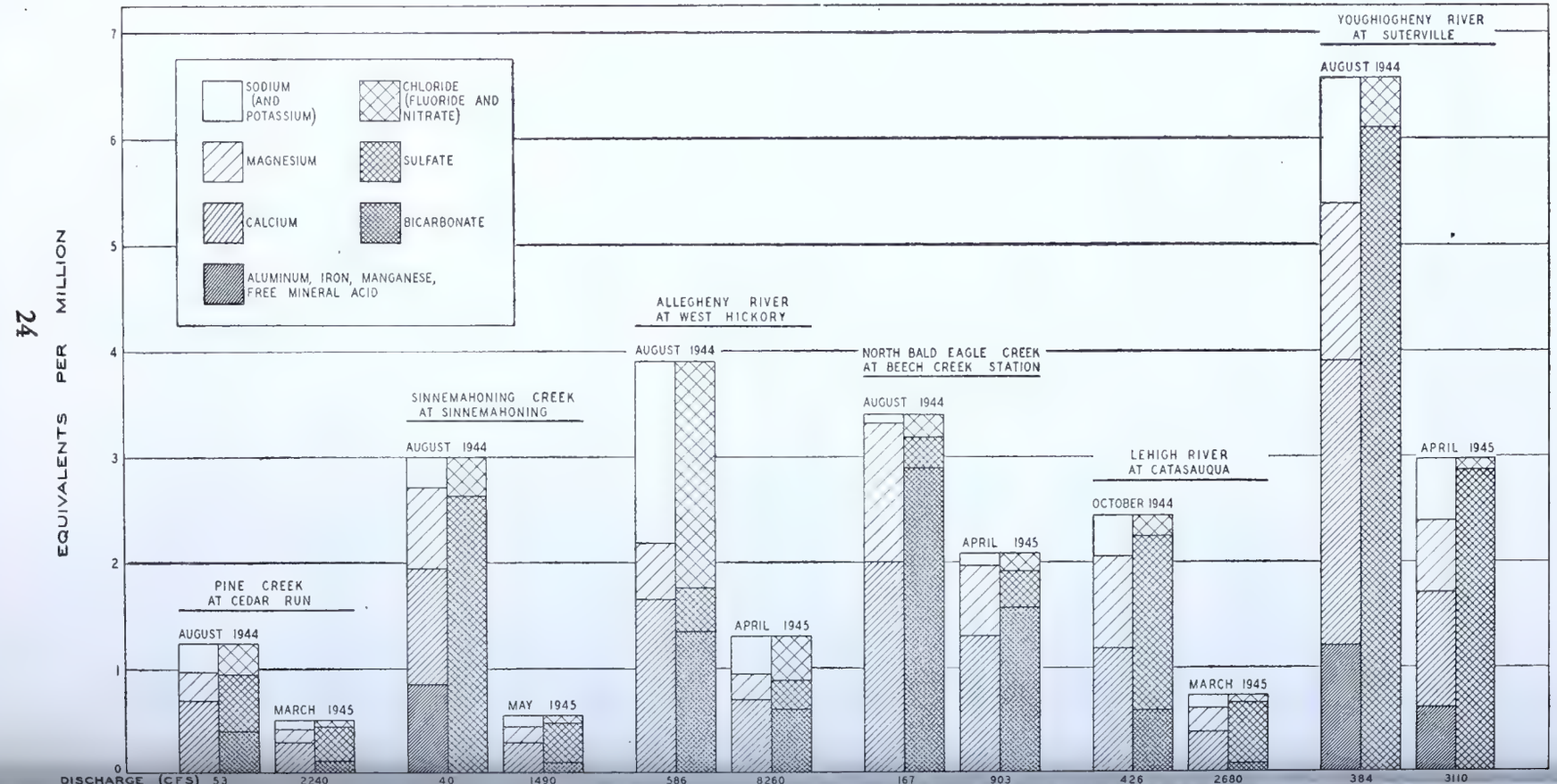
2. Continuation of the several phases of study as a unified operation with increased emphasis on development of data within single basins.

3. Instigation of specialized and intensive investigations for specific purposes in critical areas, through application of present methods of study to smaller areas, or through tests for characteristics of water not now being determined.

4. Development of a system whereby analytical data obtained by other agencies in connection with their specific studies can be fitted into this investigation in order that Pennsylvania may have complete integration of analytical data on its water resources.

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ANALYSES SHOWING MINERAL CONTENT OF SOME PENNSYLVANIA STREAMS AT LOW FLOW AND AT HIGH FLOW 1944–1945



LOW-FLOW HIGH-FLOW STUDIES

Collection and chemical analysis of single samples of low flow and of high flow at gaging stations offer a quick means of obtaining early in an investigation preliminary information about chemical quality of water and the probable extent of variation in quality that can be expected with changes in discharge. These data aid in selection of places or areas for more intensive study and provide information useful for correlation with analytical data for samples collected in connection with other phases.

Analyses of samples collected in 1944-46 at 137 gaging stations in Pennsylvania, once during a period of low flow and again during a period of higher flow, are given in the table on page 42. Samples were obtained at 20 places in the Delaware River Basin, at 67 places in the Susquehanna River Basin, at 44 places in the Ohio River Basin, at 4 places in the Potomac River Basin, and at 2 places in the St. Lawrence River Basin. Although the analyses are for single samples only, they help to show in a general way the chemical character of the water that can be found in many of the streams in Pennsylvania.

The distribution of values for some of the chemical characteristics reported in the table of analyses are given in table C on the following page. The frequency of occurrence in the various ranges of characteristics reported is based only on the analyses reported for samples of low flow and of high flow, and is not necessarily representative of all of the streams in each basin.

In general, with a change in river flow from a low stage to a higher stage most of the analyses tended to show a decrease in dissolved solids, total hardness, and pH, and an increase in color and sometimes silica. Some of the streams which were acid at the time the low-flow samples were collected tended to be less acid at higher stages with a corresponding increase in pH. The chart on page 24 contains graphical representations of some of the analyses obtained.

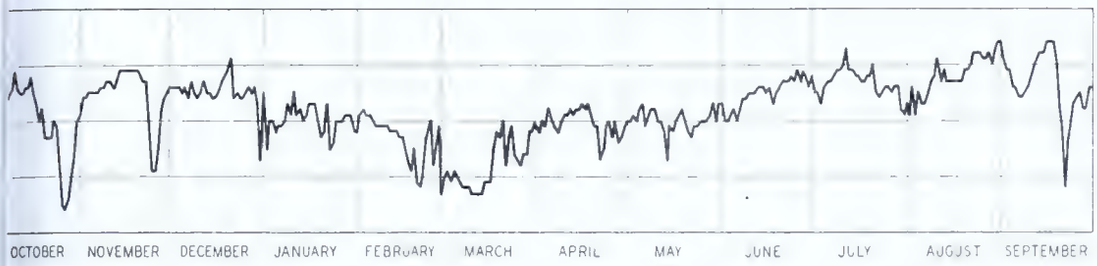
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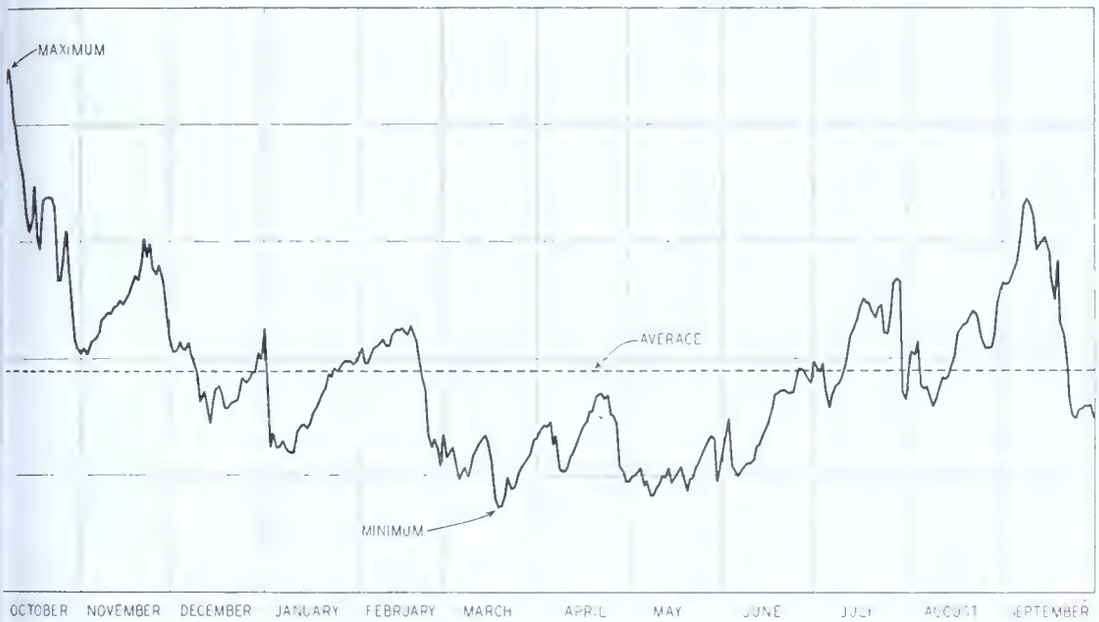
TABLE C. Distribution of values reported for analyses of 257 samples (40 from Delaware Basin, 129 from Susquehanna Basin, 88 from Ohio Basin) collected in Pennsylvania in 1944 and 1945

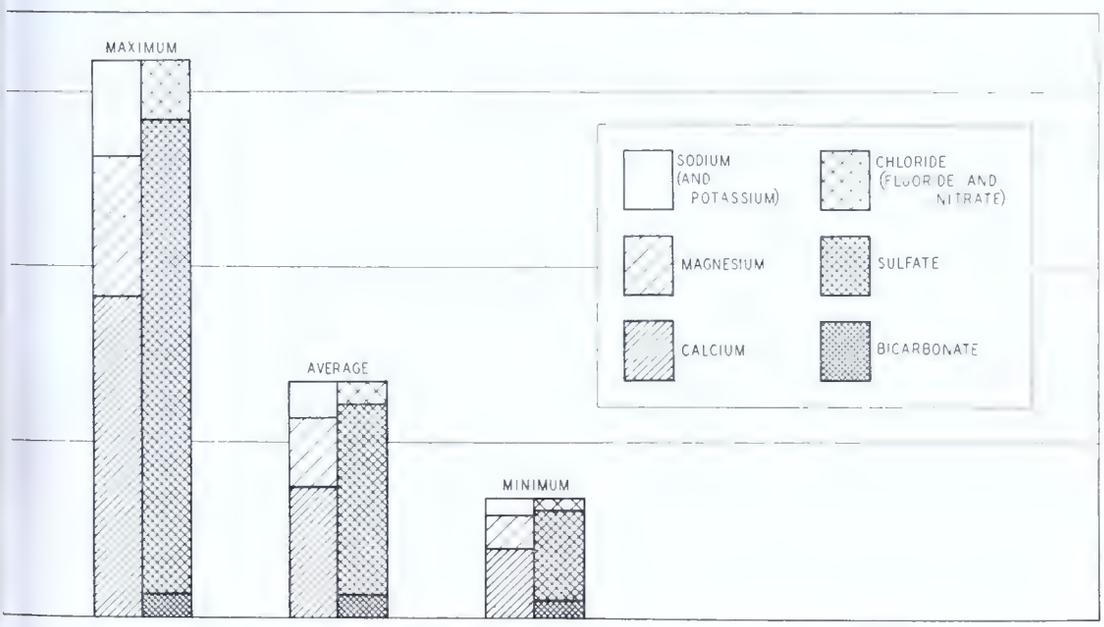
		Number of times reported in table of analyses		
Constituent	*Range (ppm)*	*Delaware Basin*	*S'quehanna Basin*	*Ohio Basin*
Hardness	Not determined	0	2	0
	0-50	20	50	16
	51-150	14	49	40
	151-300	4	21	12
	Above 300	2	7	20
Iron*	Not determined	0	11	0
	0.00-0.10	37	90	60
	.11-.50	3	20	17
	.50-10	0	6	5
	Above 10	0	2	6
Fluoride	Not determined	0	10	5
	0.0 and 0.4	38	118	74
	.5-1.5	2	1	8
	Above 1.5	0	0	1
Color	Not determined	0	2	1
	0-10	24	97	64
	11-20	11	15	16
	21-40	5	8	4
	Above 40	0	7	3
Dissolved solids	Not determined	0	2	4
	0-50	13	32	4
	51-150	17	53	32
	151-300	7	27	24
	301-1,000	3	12	19
	Above 1,000	0	3	5
pH	Less than 2.6	0	0	2
	2.6-4.5	4	21	29
	4.6-6.5	8	20	14
	6.6-8.5	28	87	42
	Above 8.5	0	1	1

*In solution at time analyzed.

DISSOLVED SOLIDS, pH, AND CHEMICAL CHARACTER
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA.
1944-1945







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AVERAGE CHEMICAL CHARACTER OF WATER AT DAILY SAMPLING STATIONS
IN PENNSYLVANIA 1945-1946
EQUIVALENTS PER MILLION
4
3
2
1
0
DELAWARE RIVER
MORRISVILLE
RICHMOND
PHILADELPHIA
CATASAUQUA
POTTSTOWN
SCHUYLKILL RIVER
SUSQUEHANNA RIVER
HARRISBURG STATION 180
NEWPORT
ALLEGHENY
PITTSBURGH
CHARLEROI
AMBRIDGE
OHIO RIVER
NEW BRIGHTON

DAILY SAMPLING STATION STUDIES

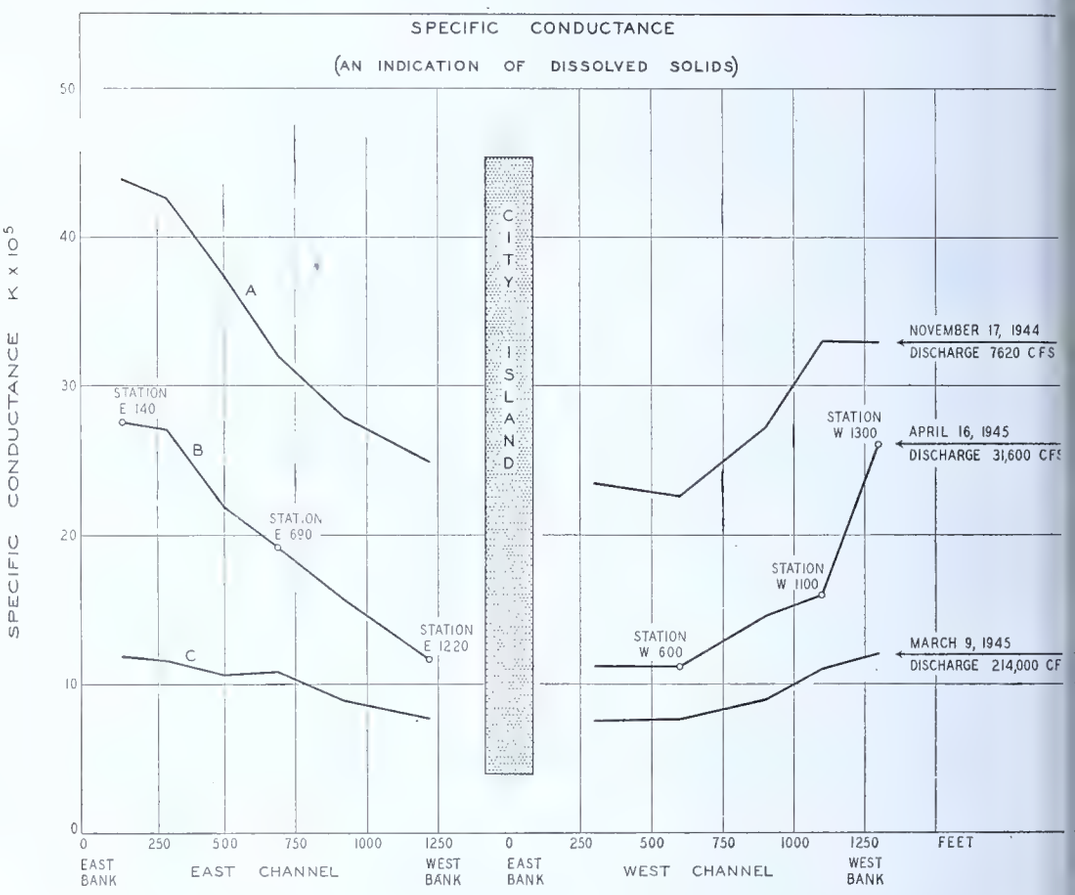
Continuous operation of daily sampling stations provides the foundation upon which the study in Pennsylvania is being built. Daily determinations of specific conductance and of hydrogen-ion concentration, plus analyses of 10-day composites of daily samples collected at these stations provide continuous records of chemical quality of water which help to show the net result of factors that affect quality of water in the drainage area above the station. While selection of places for the operation of daily sampling stations is influenced by conditions peculiar to each river basin, it is generally possible to place the stations so that they, in effect, segregate the basin into subdivisions more suitable for study. A daily sampling station serves as a reference point for tying together much of the information obtained in the other phases of study. Records at daily sampling stations allow closer estimates of probable ranges of concentrations in surface waters of contributing sources upstream from the daily sampling station. Likewise, data obtained in connection with other phases increase the chances of making more definite statements about the reasons for observed changes in concentration and character of surface waters at daily sampling stations.

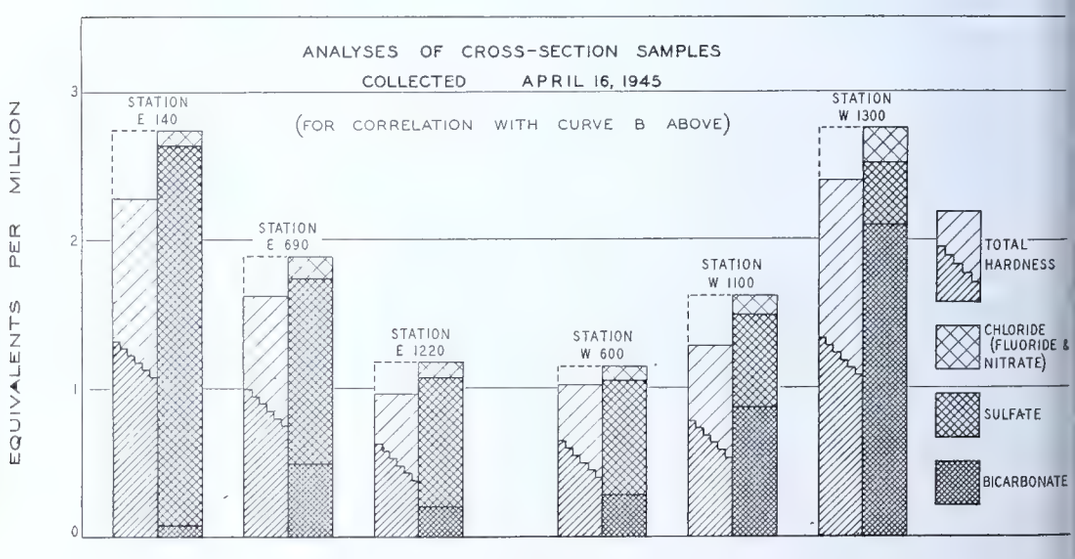
Analyses of 10-day composites of samples collected daily at 10 stations for two years, and at 6 stations for one year, are given on pages 80 to 131. The average analyses for the water year ended September 30, 1946 for 15 sampling stations are shown graphically on page 28. Graphical representation of data typical of that obtained for daily sampling station studies is given on page 27.

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SPECIFIC CONDUCTANCE AND CHEMICAL CHARACTER OF SUSQUEHANNA RIVER AT HARRISBURG

CROSS-SECTION SAMPLES COLLECTED IN 1944 AND 1945





CROSS-SECTION STUDIES

Cross-section studies are made for the purpose of determining what variations in chemical quality of water occur across the width of a stream. Samples are usually taken at from three to seven places equally spaced across the stream. The information is suitable for judging how well single samples may be considered representative of the stream. The data also aid in extending or amplifying the data obtained for other phases of study, particularly in estimating the distance above and below sampling stations for which the sampling station data may be applicable

Analyses of cross-section samples obtained periodically at Harrisburg, Danville, and in the vicinity of Ambridge are given on pages 132 to 151. Records are available as follows:

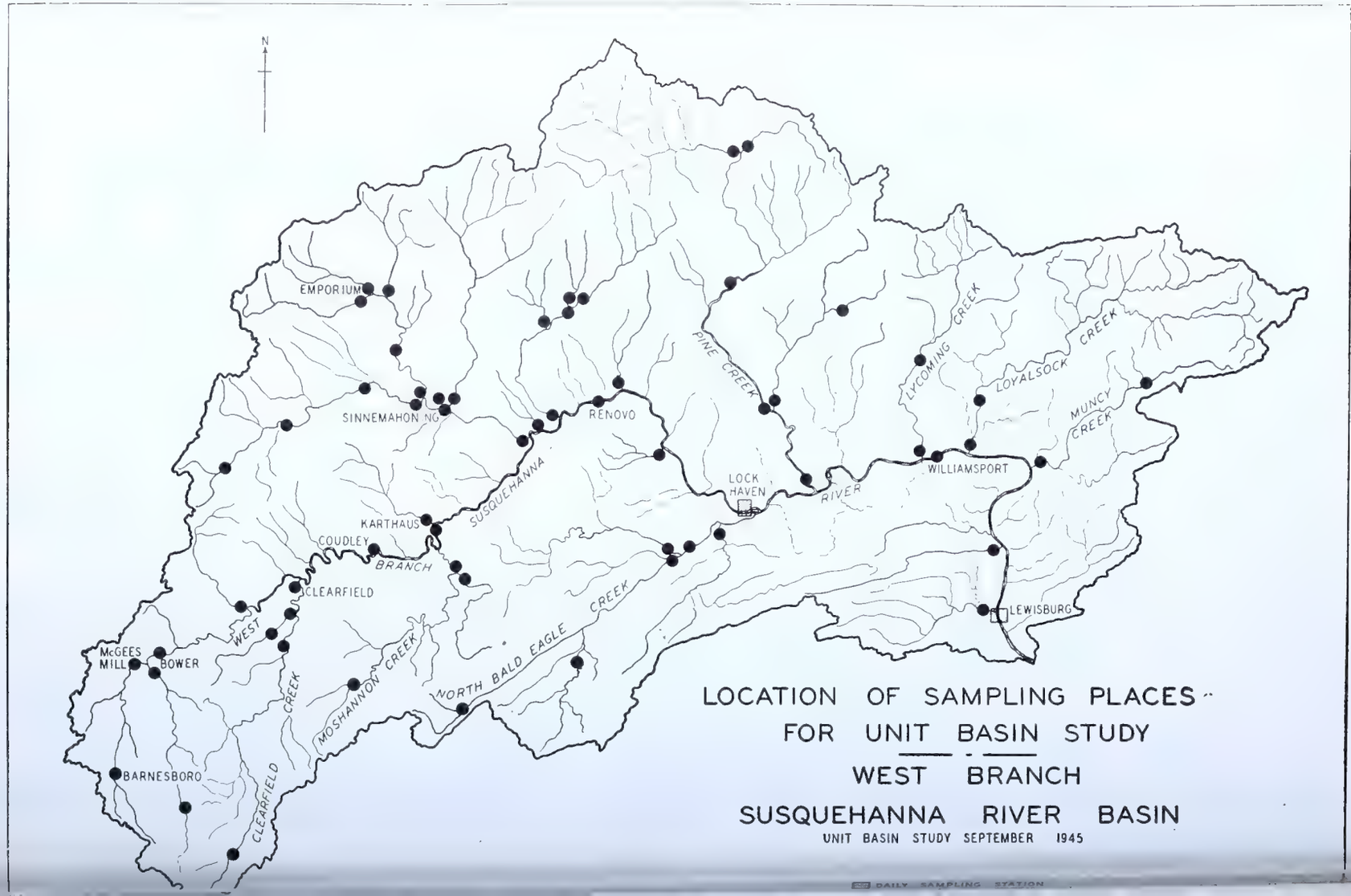
Stream	*Place*	*No. of points in cross-section*	*Times sampled per month*	*Period of record*
Susquehanna	Harrisburg	11	3	1944-46
Susquehanna	Danville	5	3	1945-46
Ohio	Sewickley	5	1	1945-46
Ohio	Ambridge	5	1	1945-46

Consistently throughout the year, the analyses show extremely wide variations in chemical character of Susquehanna River at Harrisburg, and to somewhat less degree in Susquehanna River at Danville and Ohio River in the vicinity of Ambridge.

The records show clearly the need for careful selection of sampling points at which single samples of water are collected for the purpose of representing a stream. Wide variations in quality appear even through large changes in discharge.

Data typical for that obtained in cross-section studies are shown on page 30.

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N
EMPORIUM
SINNEMAHON NO
RENOVO
PINE CREEK
LYCOMING CREEK
LOYALSOCK CREEK
MUNCY CREEK
WILLIAMSPORT
LOCK HAVEN
RIVER
SUSQUEHANNA
KARTHAUS
COUDLEY
BRANCH
CLEARFIELD
WEST
McGEES MILL
BOWER
MOSHANNON CREEK
NORTH BALD EAGLE CREEK
LEWISBURG
BARNESBORO
CLEARFIELD CREEK
LOCATION OF SAMPLING PLACES
FOR UNIT BASIN STUDY
WEST BRANCH
SUSQUEHANNA RIVER BASIN
UNIT BASIN STUDY SEPTEMBER 1945
DAILY SAMPLING STATION

UNIT BASIN STUDIES

The unit basin studies provide analyses of water samples collected at essentially the same time from most of the streams within an area. The areas are selected with reference to the location of daily sampling stations within a basin and to the immediate need for data. Usually, studies are made at times when precipitation is negligible and runoff is fairly constant. Chemical analyses of the samples are studied for their apparent effect at the time of sampling on the chemical quality of daily stations for which more comprehensive data are available. Increased reliability of estimates of probable variations in quality of river water that may be expected can be obtained through comparison of discharge and analytical data obtained for unit basin studies with data obtained in connection with low-flow high-flow studies in the same area. Because the samples for this phase of study are obtained during periods when there is little precipitation, analyses are particularly useful for indicating relative effects of inflow from ground water and from other sources such as industrial wastes. It should be emphasized that unit basin studies do not give information about the chemical quality of water at the places sampled over a long period of time.

Analyses of samples collected for unit basin studies in West Branch Susquehanna River Basin and Lehigh River Basin in 1945, and in Beaver River Basin in 1946 are given on pages 152 to 159. In general, the analyses of samples collected from different points along the main river stem help to indicate, for the period of sampling, overall changes in quality as the water passes downstream. Analyses of samples collected near the upper and lower ends of tributaries serve two major purposes; (1) illustrating any differences in quality of water in the tributaries sampled, and (2) indicating possible reasons for observed changes in quality of water in the main river. In turn each tributary can be treated as needed in a manner similar to the above. Data typical of that produced by unit basin studies are shown on pages 35 and 36.

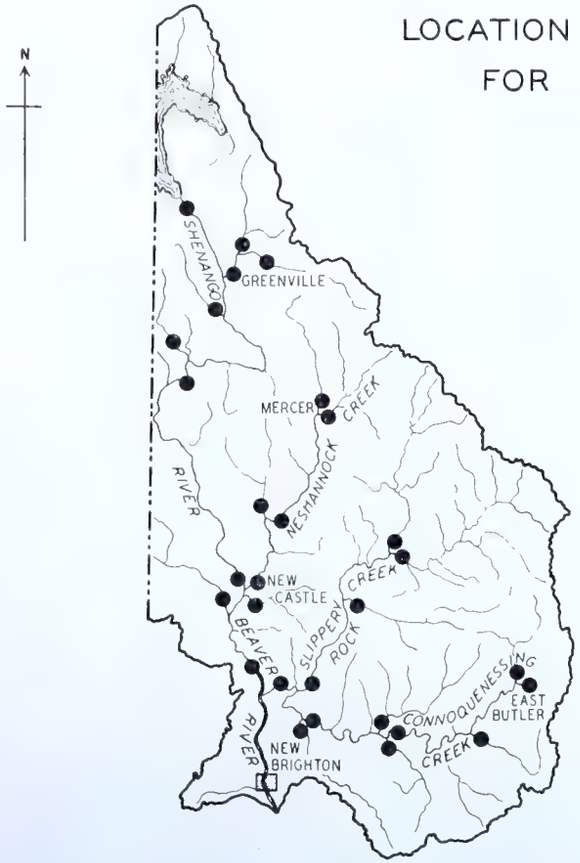
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LOCATION OF SAMPLING PLACES FOR UNIT BASIN STUDY



BEAVER RIVER BASIN

UNIT BASIN STUDY
SEPTEMBER 1946

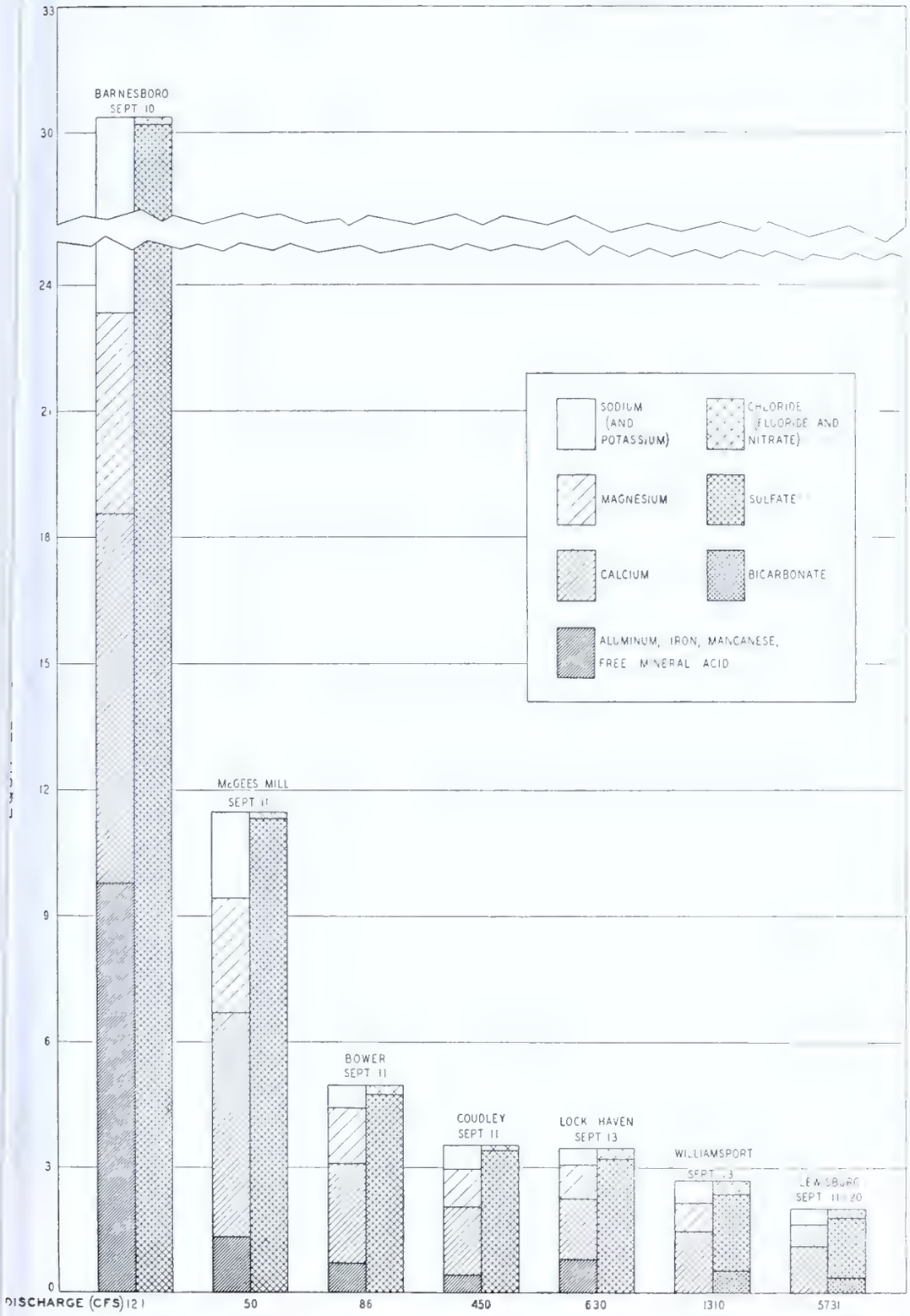


LEHIGH RIVER BASIN

UNIT BASIN STUDY
OCTOBER–NOVEMBER 1945

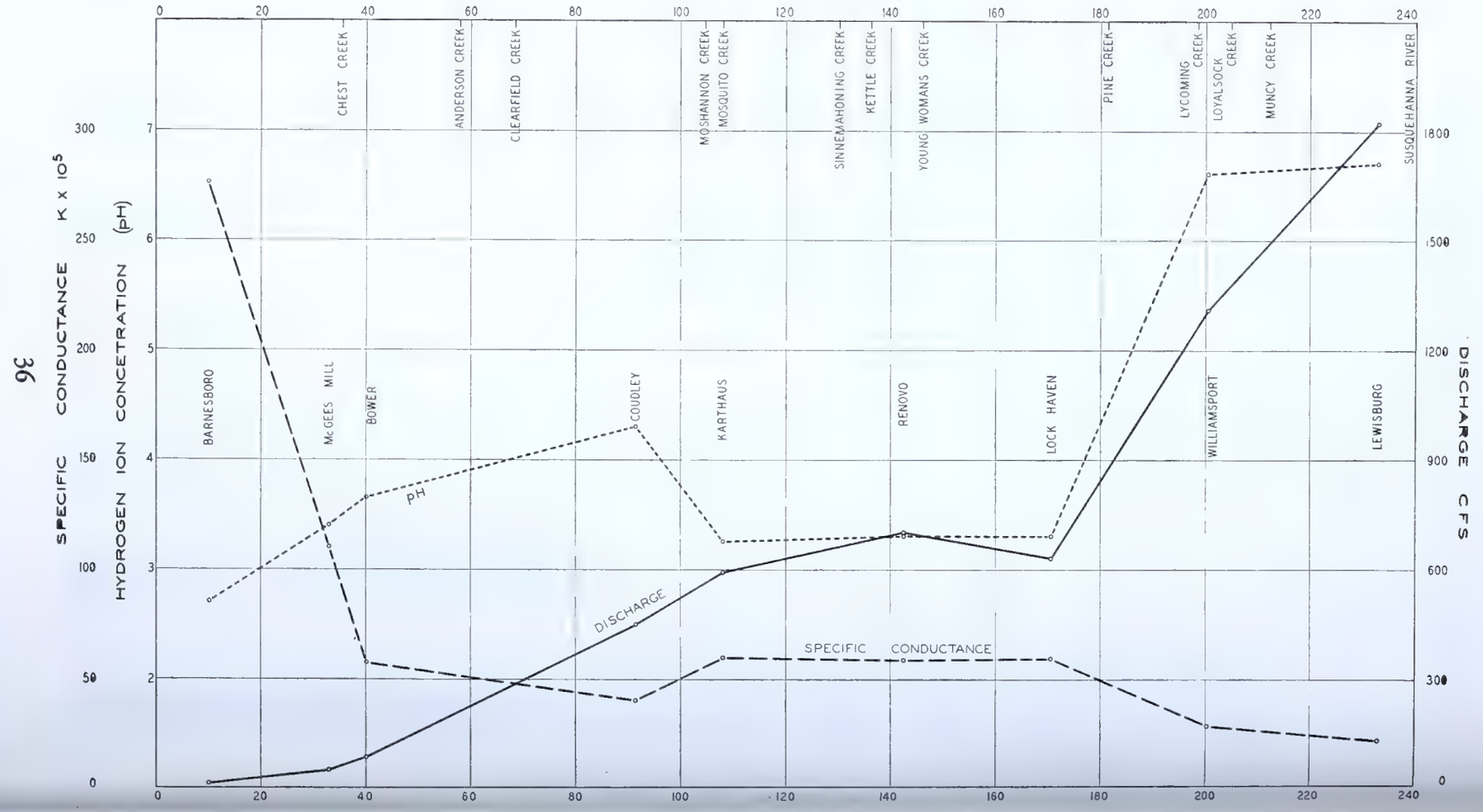
● UNIT BASIN SAMPLE

ANALYSES OF WEST BRANCH SUSQUEHANNA RIVER
SEPTEMBER 1945



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DISCHARGE, pH, AND SPECIFIC CONDUCTANCE OF WEST BRANCH SUSQUEHANNA RIVER
SEPTEMBER 1945



MISCELLANEOUS STUDIES

Miscellaneous samples which do not at present readily fit into other phases of study mentioned above are collected from time to time.

Partial analyses of some of the samples considered in this group are given on page 160. Analyses of samples from the upper Allegheny River indicate the area in which occurs at times a large increase in concentration of chloride in the river water. Analyses of samples collected from Codorus Creek above York show large changes in values for color.

COLLECTION OF SAMPLES

The single samples of low flow and high flow were collected for the State-wide reconnaissance by employees of the Pennsylvania Department of Forests and Waters. The samples were obtained at the time a discharge measurement was made, either by wading the stream or by sampling from a bridge near the gaging station. The method of collection provides a single composite sample made up of small portions of water from approximately equally spaced intervals across the stream. The containers were one-gallon pyrex bottles.

For the daily sampling stations it was generally found convenient to employ someone living near a station who would be available for collecting the sample each day. At some of the stations it was possible to make use of services provided by plants withdrawing water from the river at the point for which data were required. The samples were taken in 12-oz. bottles equipped with pressure stoppers. Field studies were made at the sampling stations for the purpose of selecting a point in the river cross-section that could be considered representative of most of the total flow of the river passing the sta-

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tion. Sampling of the Susquehanna River at Harrisburg consisted of the collection of a daily sample from the east channel about 1180 feet from the east bank, and the collection of a set of 11 samples from selected points in both channels of the river about three times a month. Sampling of the Susquehanna River at Danville and the Ohio River in the vicinity of Ambridge required similar treatment.

For other studies samples were collected by employees of the Department of Forests and Waters, or of the Geological Survey. Essentially the same methods of collecting samples were used here as for the collection of the single samples of high flow and low flow.

The samples usually were sent to Washington for analysis in the Water Resources Laboratory of the Geological Survey.

METHODS OF ANALYSIS

The methods for chemical analysis of the water samples are those currently used by the Water Resources Laboratory of the Geological Survey.[3] Fluoride was determined by the modified zirconium-alizarin method reported by Lamar.[4] Hydrogen-ion concentration, pH, was determined electrometrically after the samples were received in Washington. The specific conductance as $K \times 10^5 (25^\circ C)$ was determined by use of a Wheatstone bridge arrangement suggested by Wilcox [5] and a pipette cell for medium conductance.

For convenience, the analyses are reported in equivalents per million as well as in parts per million. The quantities of suspended sediment and material precipitated before the analysis was begun were determined only for the daily sampling stations. Unless otherwise indicated, the values reported for iron and manganese represent quantities in solution at time of analysis. The quantity reported for dissolved solids is the residue on evaporation after heating at 180°C for one hour. For samples with pH 5.0 or less, aluminum, manganese, and total acidity are reported in addition to the regular determinations. The

[3] Collins, W. D., Notes on practical water analysis: U. S. Geol. Survey Water-Supply Paper 596-H, pp. 236-261, 1928.

[4] Lamar, William L., Determination of fluoride in water: Anal. Edit. Ind. and Eng. Chem., vol. 17, pages 148-149, March 1945.

[5] Methods of analysis used in the Rubidoux Laboratory, Riverside, Calif.: U. S. Dept. of Agri. Bur. of Plant Industry, pp. 13-17, July 1942.

total acidity is reported as equivalent H_2SO_4, and is obtained by titration to the phenolphthalein end point at boiling temperature. Total hardness is reported as the calculated $CaCO_3$ equivalent to all of the significant cations except sodium and potassium.

Composites for complete analysis are made up of equal quantities of each of the daily samples so that three composite analyses are available each month—one for the 1-10 period, one for the 11-20 period, and one for the 21-to end of month period. Specific conductance and hydrogen-ion concentration were determined for each daily sample before compositing.

DISCUSSION OF ANALYTICAL DATA

Chemical analyses of samples collected for the investigation of industrial utility of surface waters of Pennsylvania during the period July 1944 to September 1946, are grouped according to the different phases of study presented earlier. Location of the sampling points are shown on page 20. Records of analytical data available for each phase of study, and information about methods of collection and analysis of samples are given prior to the tables of analyses.

Unpublished data available in files of the Geological Survey at Washington include daily determinations of temperature, specific conductance, and the pH for daily sampling stations listed on page 41.

This investigation is meeting the immediate needs of the Commonwealth for information on industrial utility of Pennsylvania's surface waters and is providing chemical analyses useful for many purposes. The data obtained for each phase of study illustrate fundamental principles relating to the source of water in a stream and its chemical quality. Through cooperation and coordination of the several phases of study the investigation is providing a network of basic data on chemical characteristics of surface waters which will serve the overall needs of the Commonwealth with reference to complete utilization of its waters.

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945

DELAWARE RIVER BASIN

1. Delaware River near Richmond

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$		Total acidity as H_2SO_4
																				Total	Non-carbonate	
								Parts per million														
Oct. 11-20, 1944	1,890	59	8	7.1	7.52	1.8	---	0.01	---	8.6	2.0	2.9	1.3	26	12	2.0	0.1	0.2	44	30	8	---
Mar. 21-31, 1945	26,300	44	10	6.7	5.11	3.5	---	.02	0.0	5.6	1.4	1.8	.8	14	10	1.1	.1	1.3	33	20	8	---
								Equivalents per million														
Oct. 11-20, 1944	---	---	---	---	---	---	---	---	---	.429	.164	.126	.033	.426	.250	.056	.005	.003	---	---	---	---
Mar. 21-31, 1945	---	---	---	---	---	---	---	---	---	.280	.115	.078	.020	.230	.208	.031	.005	.021	---	---	---	---

2. Delaware River at Morrisville

								Parts per million														
Oct. 11-20, 1944	2,610	59	9	7.2	18.0	2.0	---	0.01	0.0	19	6.5	5.4	1.8	53	30	6.1	0.0	3.5	102	74	31	---
Mar. 21-31, 1945	33,100	51	10	6.7	7.21	4.2	---	.02	.0	7.6	2.3	2.3	.7	19	14	1.8	.1	1.6	44	28	13	---
								Equivalents per million														
Oct. 11-20, 1944	---	---	---	---	---	---	---	---	---	.948	.535	.235	.046	.869	.625	.172	.000	.056	---	---	---	---
Mar. 21-31, 1945	---	---	---	---	---	---	---	---	---	.379	.189	.100	.018	.311	.292	.051	.005	.026	---	---	---	---

3. Lackawaxen River at Honesdale

								Parts per million														
Aug. 31, 1944	10.9	73	10	7.1	8.75	0.5	---	0.02	---	12	1.5	3.7	36	11	2.0	0.1	0.2	49	36	7	---	
Mar. 30, 1945	203	57	11	6.8	5.92	2.1	---	.01	0.0	7.8	1.2	1.7	16	12	1.1	.1	1.0	39	24	11	---	
								Equivalents per million														
Aug. 31, 1944	---	---	---	---	---	---	---	---	---	.599	.123	.161	.590	.229	.056	.005	.003	---	---	---	---	---
Mar. 30, 1945	---	---	---	---	---	---	---	---	---	.389	.099	.076	.262	.250	.031	.005	.016	---	---	---	---	---

4. Bushkill Creek at Shoemakers

								Parts per million														
July 28, 1944	35.4	70	15	6.9	3.30	3.1	---	0.01	---	3.3	1.4	1.4	10	7.6	0.5	0.1	0.0	24	14	6	---	
Apr. 4, 1945	427	51	36	6.2	2.91	3.0	---	.01	0.0	3.4	1.2	.9	7	7.6	.8	.2	.2	27	13	8	---	
								Equivalents per million														
July 28, 1944	---	---	---	---	---	---	---	---	---	.165	.115	.061	.164	.158	.014	.005	.000	---	---	---	---	---
Apr. 4, 1945	---	---	---	---	---	---	---	---	---	.170	.099	.040	.115	.158	.022	.011	.003	---	---	---	---	---

DELAWARE RIVER BASIN--Continued

5. Lehigh River at Stoddartsville

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (K x 10^6 at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
July 29, 1944	43.5	70	25	6.2	3.92	2.4	---	0.02	---	4.3	1.1	1.7		9	8.0	2.0	0.1	0.2	29	15	8	---
Apr. 2, 1945	237	51	30	5.8	3.44	2.1	---	.03	0.0	3.5	.9	1.0		5	8.0	1.0	.2	.3	27	12	8	---
								Equivalents per million														
July 29, 1944	---	---	---	---	---	---	---	---	---	.215	.090	.074		.148	.167	.056	.005	.003	---	---	---	---
Apr. 2, 1945	---	---	---	---	---	---	---	---	---	.175	.074	.044		.082	.167	.028	.011	.005	---	---	---	---

6. Lehigh River at Tannery

								Parts per million														
July 29, 1944	175	72	13	6.9	2.97	1.2	---	0.01	---	3.3	1.1	0.9		7	6.5	1.0	0.0	1.0	23	13	7	---
Apr. 2, 1945	770	53	27	5.9	2.66	1.7	---	.01	0.0	2.9	.8	1.5		5	7.4	.8	.2	.4	23	11	6	---
								Equivalents per million														
July 29, 1944	---	---	---	---	---	---	---	---	---	.165	.090	.039		.115	.135	.028	.000	.016	---	---	---	---
Apr. 2, 1945	---	---	---	---	---	---	---	---	---	.145	.066	.065		.082	.154	.023	.011	.006	---	---	---	---

7. Lehigh River at Catasauqua

								Parts per million														
Oct. 11-20, 1944	426	53	6	7.1	25.2	5.0	---	0.03	0.7	26	9.5	7.1	3.2	35	75	3.8	0.1	4.8	157	104	75	---
Mar. 21-31, 1945	2,680	51	5	5.9	8.51	4.3	---	.04	.2	7.5	2.8	2.4	.6	5	29	1.8	.1	1.1	53	30	26	---
								Equivalents per million														
Oct. 11-20, 1944	---	---	---	---	---	---	---	---	---	1.298	.781	.309	.082	.574	1.624	.107	.005	.077	---	---	---	---
Mar. 21-31, 1945	---	---	---	---	---	---	---	---	---	.374	.230	.104	.015	.082	.604	.042	.005	.018	---	---	---	---

8. Pohopoco Creek near Parryville

								Parts per million														
July 29, 1944	60.9	75	7	6.7	3.13	4.9	---	0.01	---	2.8	1.2	3.2		9	8.4	1.0	0.1	1.4	23	12	5	---
Apr. 4, 1945	238	50	13	6.3	3.33	5.1	---	.02	0.0	3.2	1.3	2.2		8	6.6	1.4	.1	1.1	25	13	7	---
								Equivalents per million														
July 29, 1944	---	---	---	---	---	---	---	---	---	.140	.090	.140		.148	.175	.028	.000	.023	---	---	---	---
Apr. 4, 1945	---	---	---	---	---	---	---	---	---	.160	.107	.095		.131	.137	.039	.005	.050	---	---	---	---

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945—Continued

DELAWARE RIVER BASIN—Continued

9. Jordan Creek at Allentown

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Sept. 2, 1944	4.20	59	10	7.3	41.1	5.8	---	0.02	---	47	21	6.9		130	93	3.8	0.1	12	262	204	97	---
Apr. 5, 1945	238	50	10	7.3	16.8	6.1	---	.06	0.0	19	5.3	5.3		47	29	3.2	.1	9.0	107	69	31	---
								Equivalents per million														
Sept. 2, 1944	---	---	---	---	---	---	---	---	---	2.346	1.727	.300		2.131	1.936	.107	.005	.194	---	---	---	---
Apr. 5, 1945	---	---	---	---	---	---	---	---	---	.948	.436	.230		.770	.604	.090	.005	.145	---	---	---	---

10. Monocacy Creek at Bethlehem

								Parts per million														
Aug. 30, 1944	14.4	59	6	8.1	36.6	5.8	---	0.02	---	43	21	1.5		[a]186	29	3.6	0.1	11	213	194	41	---
Apr. 5, 1945	33.2	50	8	7.8	36.0	6.4	---	.06	0.0	44	17	4.7		158	45	3.8	.1	10	222	180	50	---
								Equivalents per million														
Aug. 30, 1944	---	---	---	---	---	---	---	---	---	2.146	1.727	.064		3.049	.604	.102	.005	.177	---	---	---	---
Apr. 5, 1945	---	---	---	---	---	---	---	---	---	2.196	1.398	.206		2.590	.937	.107	.005	.161	---	---	---	---

11. Tohickon Creek near Pipersville

								Parts per million														
July 26, 1944	0.89	79	15	7.8	23.9	2.1	---	0.01	---	23	9.5	12		81	42	8.0	0.2	0.3	142	96	30	---
Apr. 4, 1945	137	57	35	7.2	15.7	13	---	.12	0.0	14	6.2	6.2		42	30	5.2	.1	1.0	106	60	26	---
								Equivalents per million														
July 26, 1944	---	---	---	---	---	---	---	---	---	1.148	.781	.515		1.328	.874	.226	.011	.005	---	---	---	---
Apr. 4, 1945	---	---	---	---	---	---	---	---	---	.699	.510	.272		.688	.625	.147	.005	.016	---	---	---	---

12. Neshaminy Creek near Langhorne

								Parts per million														
July 26, 1944	22.8	80	9	7.2	18.0	9.0	---	0.01	---	16	6.1	9.8		59	23	7.9	0.1	3.4	109	65	17	---
Apr. 3, 1945	186	67	12	8.4	17.1	6.7	---	.08	0.0	14	5.4	12		[b]45	29	8.5	.0	5.0	104	57	20	---
								Equivalents per million														
July 26, 1944	---	---	---	---	---	---	---	---	---	.799	.502	.428		.967	.479	.223	.005	.055	---	---	---	---
Apr. 3, 1945	---	---	---	---	---	---	---	---	---	.699	.444	.520		.738	.604	.240	.000	.081	---	---	---	---

13. Schuylkill River at Pottsville

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
July 30, 1944	40.3	64	5	3.6	103	17	19	0.06	8.8	92	52	7.6		0	565	3.0	0.1	0.0	643	576	576	176
Apr. 2, 1945	134	53	2	3.45	87.2	10	21	.28	4.4	60	41	7.2	2.0	0	450	1.5	.6	.1	637	463	463	184
								Equivalents per million														
July 30, 1944	---	---	---	---	---	---	2.113	.003	.320	4.592	4.276	.329		.000	11.763	.085	.005	.000	---	---	---	---
Apr. 2, 1945	---	---	---	---	---	---	2.330	.010	.160	2.995	3.372	.313	.051	.000	9.369	.042	.032	.002	---	---	---	---

14. Schuylkill River at Pottstown

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Oct. 11-20, 1944	442	[illegible]	3	7.0	[illegible].4	[illegible].2	---	[illegible].02	0.0	59	27	14	3.4	45	221	11	0.1	6.6	393	258	221	---
Mar. 21-31, 1945	2,180	[illegible]	1	6.7	27.7	7.0	--	.01	0.0	28	11	7.6	1.5	30	92	5.1	.1	4.6	176	115	90	---
								Equivalents per million														
Oct. 11-20, 1944	---	---	---	---	---	---	---	---	---	2.945	2.220	.609	.087	.738	4.601	.310	.005	.106	---	---	---	---
Mar. 21-31, 1945	---	---	---	---	---	---	---	---	---	1.398	.905	.330	.038	.492	1.915	.144	.005	.074	---	---	---	---

15. Little Schuylkill River at Tamaqua

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
July 26, 1944	9.77	79	3	4.2	28.3	8.6	5.0	0.02	1.3	25	8.9	5.3		0	123	10	0.0	0.1	192	131	131	31
Apr. 2, 1945	70.2	51	2	3.80	33.0	9.2	5.7	.05	1.0	24	11	2.6	0.4	0	139	1.5	.6	2.1	200	147	147	51
								Equivalents per million														
July 26, 1944	---	---	---	---	---	---	.556	.000	.047	1.248	.732	.230		.000	2.561	.282	.000	.002	---	---	---	---
Apr. 2, 1945	---	---	---	---	---	---	.634	.003	.036	1.198	.905	.113	.010	.000	2.894	.042	.032	.034	---	---	---	---

16. Perkiomen Creek at Graters Ford

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
July 26, 1944	45.2	84	8	7.4	21.8	7.6	---	0.03	---	24	9.0	6.0		94	24	5.1	0.1	0.7	123	97	20	---
Apr. 4, 1945	266	58	18	7.4	17.1	10	---	.05	0.0	16	6.4	8.1		54	29	5.0	.0	2.9	107	66	22	---
								Equivalents per million														
July 26, 1944	---	---	---	---	---	---	---	---	---	1.198	.740	.263		1.541	.500	.144	.005	.011	---	---	---	---
Apr. 4, 1945	---	---	---	---	---	---	---	---	---	.799	.526	.352		.885	.604	.141	.000	.047	---	---	---	---

Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

DELAWARE RIVER BASIN--Continued

17. Ridley Creek at Moylan

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$		Total acidity as H_2SO_4
																				Total	Noncarbonate	
								Parts per million														
July 25, 1944	4.26	77	5	6.9	13.5	13	---	0.02	---	9.6	5.4	6.8	35	13	8.8	0.1	7.5	82	46	17	---
Apr. 3, 1945	49.7	60	15	7.0	11.2	14	---	.10	0.0	8.0	4.7	7.1	34	13	5.8	.0	6.4	76	39	11	---
								Equivalents per million														
July 25, 1944	---	---	---	---	---	---	---	---	---	.479	.444	.296	.574	.271	.248	.005	.121	---	---	---	---	---
Apr. 3, 1945	---	---	---	---	---	---	---	---	---	.399	.387	.309	.557	.271	.164	.000	.103	---	---	---	---	---

18. Chester Creek near Chester

								Parts per million														
June 25, 1944	19.5	76	10	7.2	16.2	15	---	0.02	---	12	5.5	11	48	18	10	0.1	4.9	101	53	13	---
Apr. 3, 1945	81.8	61	18	7.1	13.2	14	---	.17	0.0	10	4.6	8.4	38	16	6.5	.0	6.5	87	44	13	---
								Equivalents per million														
June 25, 1944	---	---	---	---	---	---	---	---	---	.599	.452	.477	.787	.375	.282	.005	.079	---	---	---	---	---
Apr. 3, 1945	---	---	---	---	---	---	---	---	---	.499	.378	.367	.623	.333	.183	.000	.105	---	---	---	---	---

19. Brandywine Creek at Chadds Ford

								Parts per million														
July 25, 1944	241	76	8	7.2	19.8	9.2	---	0.06	---	16	5.8	14	61	17	16	0.1	3.4	116	64	14	---
Apr. 2, 1945	315	62	12	7.1	13.0	8.1	---	.06	0.0	12	4.6	6.7	44	15	5.5	.0	.0	80	49	13	---
								Equivalents per million														
July 25, 1944	---	---	---	---	---	---	---	---	---	.799	.477	.589	1.000	.354	.451	.005	.055	---	---	---	---	---
Apr. 2, 1945	---	---	---	---	---	---	---	---	---	.599	.378	.293	.721	.312	.155	.000	.082	---	---	---	---	---

20. West Branch Brandywine Creek at Coatesville

								Parts per million														
Sept. 5, 1944	6.84	76	8	7.4	10.8	12	---	0.02	---	10	3.9	4.7	43	9.5	3.8	0.0	1.0	66	41	6	---
May 9, 1945	63.6	55	15	7.2	9.97	11	---	.02	0.0	8.8	3.8	4.4	31	13	3.8	.1	3.2	67	38	12	---
								Equivalents per million														
Sept. 5, 1944	---	---	---	---	---	---	---	---	---	.499	.321	.206	.705	.198	.107	.000	.016	---	---	---	---	---
May 9, 1945	---	---	---	---	---	---	---	---	---	.439	.312	.192	.508	.271	.107	.005	.052	---	---	---	---	---

21. Susquehanna River at Towanda

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
July 21, 1944	1,570	69	7	7.7	22.3	1.0	---	---	---	31	6.2	4.6		100	19	7.0	0.1	1.2	129	103	21	---
Mar. 28, 1945	26,000	53	6	6.6	13.0	3.4	---	0.01	0.0	17	3.2	3.5		44	18	3.4	.1	4.2	78	56	20	---
								Equivalents per million														
July 21, 1944	---	---	---	---	---	---	---	---	---	1.547	.510	.199		1.639	.396	.197	.005	.019	---	---	---	---
Mar. 28, 1945	---	---	---	---	---	---	---	---	---	.848	.263	.154		.721	.375	.096	.005	.068	---	---	---	---

22. Susquehanna River at Falls

								Parts per million														
Sept. 7, 1944	1,080	73	9	7.8	27.0	1.0	---	0.18	---	33	6.3	13		108	24	15	0.2	0.4	147	108	20	---
Oct. 11-20, 1944	3,000	56	10	7.8	22.4	.6	---	.01	0.0	29	5.2	8.5	1.9	90	21	10	.0	.8	125	94	20	---
Mar. 21-31, 1945	47,500	47	12	7.1	10.3	4.8	---	.09	.0	14	2.4	2.5	.9	38	14	2.4	.1	1.9	63	45	14	---
								Equivalents per million														
Sept. 7, 1944	---	---	---	---	---	---	---	---	---	1.647	.518	.545		1.770	.500	.423	.011	.006	---	---	---	---
Oct. 11-20, 1944	---	---	---	---	---	---	---	---	---	1.448	.428	.370	.049	1.475	.437	.282	.000	.013	---	---	---	---
Mar. 21-30, 1945	---	---	---	---	---	---	---	---	---	.699	.197	.109	.023	.623	.292	.068	.005	.031	---	---	---	---

23. Susquehanna River at Wilkes-Barre

								Parts per million														
July 29, 1944	2,010	81	10	6.7	35.0	1.6	---	0.03	---	41	14	2.9		64	94	10	0.1	1.9	218	160	107	---
Apr. 4, 1945	22,900	53	5	7.1	16.1	3.7	---	.01	0.0	20	5.1	3.0		40	37	2.6	.1	2.8	94	71	38	---
								Equivalents per million														
July 29, 1944	---	---	---	---	---	---	---	---	---	2.046	1.151	.127		1.049	1.957	.282	.005	.031	---	---	---	---
Apr. 4, 1945	---	---	---	---	---	---	---	---	---	.998	.419	.132		.656	.770	.073	.005	.045	---	---	---	---

24. Susquehanna River at Sunbury

								Parts per million														
Aug. 8, 1944	3,350	78	4	5.7	40.7	2.6	---	0.35	---	44	17	6.3		4	162	8.8	0.1	11	275	180	176	---
Mar. 16, 1945	76,900	46	4	6.8	11.6	4.3	---	.03	0.0	13	3.6	2.8		16	33	2.5	.1	2.6	69	47	34	---
								Equivalents per million														
Aug. 8, 1944	---	---	---	---	---	---	---	---	---	2.196	1.398	.275		.066	3.373	.248	.005	.177	---	---	---	---
Mar. 16, 1945	---	---	---	---	---	---	---	---	---	.649	.296	.122		.262	.687	.071	.005	.042	---	---	---	---

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

SUSQUEHANNA RIVER BASIN--Continued

25. Susquehanna River at Harrisburg

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10^6 at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
									Parts per million													
East channel																						
Station Date	(c)																					
140 10-16-44		49	4	5.0	52.0	---	---	---	---	---	---	---	---	i	233	7.0	---	---	---	234	233	---
300 10-16-44		50	3	5.7	50.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
500 10-16-44		49	3	6.2	44.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
690 10-16-44		50	6	6.7	35.9	---	---	---	---	---	---	---	---	18	135	7.0	---	---	---	163	138	---
920 10-16-44		50	7	6.7	29.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1180 (a)		55	7	7.0	29.3	2.6	---	0.02	0.0	31	9.6	9.7	2.7	26	101	7.8	0.1	1.6	185	117	96	---
1220 10-16-44		50	7	6.6	26.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
West channel																						
Station Date																						
300 10-16-44		49	7	6.8	25.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
600 10-16-44		49	11	7.1	28.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
900 10-16-44		50	18	7.4	33.9	---	---	---	---	---	---	---	---	96	76	10	---	---	---	126	47	---
1100 10-16-44		49	18	7.4	33.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1300 10-16-44		49	7	7.7	30.5	---	---	---	---	---	---	---	---	153	18	6.0	---	---	---	144	19	---
East channel																						
Station Date	(d)																					
120 3-26-45		46	8	6.4	13.2	---	---	---	---	---	---	---	---	15	44	1.5	---	2.7	---	51	39	---
300 3-26-45		46	12	6.8	13.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
500 3-26-45		46	12	6.7	11.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
690 3-26-45		45	16	6.7	10.1	---	---	---	---	---	---	---	---	24	32	1.0	---	2.4	---	40	20	---
920 3-26-45		45	16	6.7	9.88	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1180 (b)		49	11	6.7	9.58	4.4	---	0.08	0.0	11	2.9	2.2	.6	18	24	1.9	.1	1.9	61	39	25	---
1220 3-26-45		47	15	6.6	9.09	---	---	---	---	---	---	---	---	18	25	2.0	---	1.8	---	36	21	---
West channel																						
Station Date																						
300 3-26-45		46	9	6.4	8.37	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
600 3-26-45		47	6	6.2	8.02	---	---	---	---	---	---	---	---	7	29	1.5	---	1.2	---	33	27	---
900 3-26-45		47	4	6.2	8.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1100 3-26-45		47	7	6.6	8.52	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1300 3-26-45		50	13	7.1	13.1	---	---	---	---	---	---	---	---	44	24	1.5	---	3.1	---	58	22	---

[a] Oct. 11-20, 1944.

[b] Mar. 21-31, 1945.

[c] Mean discharge, 7,490 second-feet for Oct. 16, 1944.

[d] Mean discharge, 125,000 second-feet for Mar. 26, 1945.

Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

SUSQUEHANNA RIVER BASIN--Continued

25. Susquehanna River at Harrisburg

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Equivalents per million														
East channel																						
Station Date																						
140 10-16-44		---	---	---	---	---	---	---	---	---	---	---	---	.016	4.851	.197	---	---	---	---	---	---
690 10-16-44		---	---	---	---	---	---	---	---	---	---	---	---	.295	2.811	.197	---	---	---	---	---	---
1180 (a)		---	---	---	---	---	---	---	---	1.547	.789	.422	.069	.426	2.103	.220	.005	.026	---	---	---	---
West channel																						
Station Date																						
900 10-16-44		---	---	---	---	---	---	---	---	---	---	---	---	1.573	1.582	.282	---	---	---	---	---	---
1300 10-16-44		---	---	---	---	---	---	---	---	---	---	---	---	2.507	.375	.169	---	---	---	---	---	---
East channel																						
Station Date																						
120 3-26-45		---	---	---	---	---	---	---	---	---	---	---	---	.246	.916	.042	---	.044	---	---	---	---
690 3-26-45		---	---	---	---	---	---	---	---	---	---	---	---	.393	.666	.028	---	.039	---	---	---	---
1180 (b)		---	---	---	---	---	---	---	---	.549	.238	.096	.015	.295	.500	.054	.005	.031	---	---	---	---
1220 3-26-45		---	---	---	---	---	---	---	---	---	---	---	---	.295	.520	.056	---	.029	---	---	---	---
West channel																						
Station Date																						
600 3-26-45		---	---	---	---	---	---	---	---	---	---	---	---	.115	.604	.042	---	.019	---	---	---	---
1300 3-26-45		---	---	---	---	---	---	---	---	---	---	---	---	.721	.500	.042	---	.050	---	---	---	---

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

SUSQUEHANNA RIVER BASIN--Continued

26. Susquehanna River at Marietta

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (K x 10^5 at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 24, 1944	3,790	73	8	6.9	38.7	2.4	---	0.01	---	40	16	11		45	131	10	0.2	1.9	251	166	129	---
May 31, 1945	53,500	64	5	7.1	22.1	4.4	---	.02	0.0	24	7.7	5.4		32	67	3.2	.2	2.8	131	92	65	---
								Equivalents per million														
Aug. 24, 1944	---	---	---	---	---	---	---	---	---	1.997	1.316	.476		.738	2.727	.282	.011	.031	---	---	---	---
May 31, 1945	---	---	---	---	---	---	---	---	---	1.198	.633	.234		.524	1.395	.090	.011	.045	---	---	---	---

27. Towanda Creek near Monroeton

								Parts per million														
Aug. 31, 1944	9.88	67	5	6.9	10.8	2.4	---	0.02	---	12	2.5	3.3		30	16	3.9	0.1	0.6	58	40	16	---
Mar. 28, 1945	420	55	8	6.7	6.32	3.7	---	.03	0.0	7.4	1.7	2.2		14	15	1.2	.1	1.5	38	25	14	---
								Equivalents per million														
Aug. 31, 1944	---	---	---	---	---	---	---	---	---	.599	.206	.145		.492	.333	.110	.005	.010	---	---	---	---
Mar. 28, 1945	---	---	---	---	---	---	---	---	---	.369	.140	.096		.230	.312	.034	.005	.024	---	---	---	---

28. North Branch Mehoopany Creek near Lovelton

								Parts per million														
Sept. 1, 1944	1.91	70	5	7.4	9.26	3.1	---	0.01	---	12	2.0	3.5		39	9.4	2.6	0.1	0.2	51	38	6	--
Mar. 29, 1945	68.2	52	11	7.0	5.74	3.7	---	.02	---	7.0	1.4	1.9		16	12	.8	.1	.3	36	23	10	---
								Equivalents per million														
Sept. 1, 1944	---	---	---	---	---	---	---	---	---	.599	.164	.153		.639	.196	.073	.005	.003	---	---	---	---
Mar. 29, 1945	---	---	---	---	---	---	---	---	---	.349	.115	.081		.262	.250	.023	.005	.005	---	---	---	---

29. Tunkhannock Creek at Dixon

								Parts per million														
Sept. 1, 1944	22.1	70	10	7.2	11.4	2.1	---	0.01	---	16	2.0	3.7		44	15	3.0	0.1	0.2	64	48	12	---
Mar. 29, 1945	695	55	9	7.2	8.18	3.0	---	.01	0.0	11	1.5	2.6		22	16	1.8	.1	2.2	49	34	16	---
								Equivalents per million														

30. Lackawanna River at Archbald

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
July 20, 1944	48.1	68	3	3.5	56.2	10	7.1	0.08	3.0	34	21	7.2		0	231	4.0	0.1	0.0	344	231	231	69
Mar. 31, 1945	199	51	3	4.0	31.3	6.0	2.0	.04	1.1	21	14	2.6	1.4	0	126	1.4	.1	.4	188	128	128	28
								Equivalents per million														
July 20, 1944	---	---	---	---	---	---	.790	.004	.109	1.697	1.727	.315		.000	4.809	.113	.005	.000	---	---	---	---
Mar. 31, 1945	---	---	---	---	---	---	.222	.002	.040	1.048	1.151	.113	.036	.000	2.623	.039	.005	.006	---	---	---	---

31. Toby Creek at Luzerne

								Parts per million														
Sept. 6, 1944	1.87	66	14	7.0	11.9	1.8	---	0.01	---	13	2.3	5.8		35	16	5.5	0.3	0.8	69	42	13	---
Apr. 3, 1945	265	53	27	6.2	7.51	3.7	---	.01	0.0	8.4	1.7	3.0		14	16	2.1	.1	3.9	51	28	16	---
								Equivalents per million														
Sept. 6, 1944	---	---	---	---	---	---	---	---	---	.649	.189	.253		.574	.333	.155	.016	.013	---	---	---	---
Apr. 3, 1945	---	---	---	---	---	---	---	---	---	.419	.140	.131		.230	.333	.059	.005	.063	---	---	---	---

32. Solomon Creek at Wilkes-Barre

								Parts per million														
Sept. 6, 1944	3.9	66	8	2.7	223	33	29	6.4	10	159	93	39		0	1,100	10	---	0.6	1,550	1,070	1,070	365
Apr. 3, 1945	20.3	61	4	3.00	123	19	18	2.8	3.8	77	45	13	1.9	0	542	6.5	0.2	.4	760	548	548	188
								Equivalents per million														
Sept. 6, 1944	---	---	---	---	---	---	3.226	.344	.364	7.936	7.648	1.712		.000	22.901	.282	---	.010	---	---	---	---
Apr. 3, 1945	---	---	---	---	---	---	2.002	.150	.138	3.843	3.701	.565	.049	.000	11.284	.183	.011	.008	---	---	---	---

33. Wapwallopen Creek near Wapwallopen

								Parts per million														
July 18, 1944	12.9	72	9	6.9	4.33	4.9	---	---	---	4.1	1.5	1.9		12	7.9	1.4	0.1	0.3	30	16	7	---
Aug. 29, 1944	6.1	60	---	6.5	4.39	---	---	---	---	---	---	---		14	---	---	---	---	---	---	---	---
Apr. 1, 1945	61.9	50	12	6.6	4.40	4.7	---	0.03	0.0	4.0	1.4	2.3		8	11	1.4	.1	.7	30	16	9	---
								Equivalents per million														
July 18, 1944	---	---	---	---	---	---	---	---	---	.205	.123	.082		.197	.164	.039	.005	.005	---	---	---	---
Aug. 29, 1944	---	---	---	---	---	---	---	---	---	---	---	---		.230	---	---	---	---	---	---	---	---
Apr. 1, 1945	---	---	---	---	---	---	---	---	---	.200	.115	.100		.131	.229	.039	.005	.011	---	---	---	---

Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

SUSQUEHANNA RIVER BASIN--Continued

34. Fishing Creek near Bloomsburg

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
July 17, 1944	84.4	75	6	7.0	4.83	4.6	---	---	---	4.8	1.0	2.1		12	7.2	1.8	0.0	2.2	33	17	7	---
Sept. 2, 1944	23.7	65	---	6.4	4.83	---	---	---	---	---	---	---		11	---	---	---	---	---	---	---	---
Mar. 22, 1945	3,400	45	17	5.9	3.93	3.6	---	0.02	0.0	3.6	1.1	1.9		6	8.7	.9	.1	2.6	29	14	9	---
								Equivalents per million														
July 17, 1944	---	---	---	---	---	---	---	---	---	.210	.132	.091		.197	.150	.051	.000	.035	---	---	---	---
Sept. 2, 1944	---	---	---	---	---	---	---	---	---	---	---	---		.180	---	---	---	---	---	---	---	---
Mar. 22, 1945	---	---	---	---	---	---	---	---	---	.180	.090	.081		.098	.181	.025	.005	.042	---	---	---	---

35. Little Fishing Creek at Eyers Grove

								Parts per million														
Aug. 28, 1944	2.93	63	8	6.9	6.57	1.6	---	0.03	---	6.7	1.7	3.7		21	8.6	3.4	0.0	1.0	37	24	6	---
Apr. 1, 1945	71.4	55	22	6.7	4.72	4.9	---	.15	0.0	4.8	1.5	3.1		12	8.6	1.5	.1	4.7	34	18	8	---
								Equivalents per million														
Aug. 28, 1944	---	---	---	---	---	---	---	---	---	.334	.140	.161		.344	.179	.096	.000	.016	---	---	---	---
Apr. 1, 1945	---	---	---	---	---	---	---	---	---	.240	.123	.136		.197	.179	.042	.005	.076	---	---	---	---

36. West Branch Susquehanna River at Bower

								Parts per million														
Aug. 7, 1944	98.2	74	4	3.3	72.2	9.2	5.7	0.14	1.1	54	16	21		0	283	5.9	---	1.6	410	258	258	68
Apr. 16, 1945	454	54	1	4.20	36.4	7.6	2.6	.03	.4	33	11	9.0	1.2	0	153	2.0	0.1	1.4	233	146	146	22
								Equivalents per million														
Aug. 7, 1944	---	---	---	---	---	---	.634	.008	.040	2.695	1.316	.922		.000	5.892	.166	---	.026	---	---	---	---
Apr. 16, 1945	---	---	---	---	---	---	.289	.002	.015	1.647	.905	.391	.031	.000	3.185	.056	.005	.023	---	---	---	---

37. West Branch Susquehanna River at Karthaus

								Parts per million														
Aug. 8, 1944	850	75	5	3.2	75.0	9.0	6.9	0.26	1.6	49	15	15		0	266	7.9	---	0.6	384	256	256	88
Apr. 17, 1945	2,490	56	2	3.60	33.3	6.8	2.8	.07	.4	22	7.6	4.8	1.0	0	114	1.4	0.1	1.0	167	116	116	35
								Equivalents per million														

38. West Branch Susquehanna River at Renovo

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 11, 1944	373	79	4	3.1	90.8	9.8	9.4	0.94	1.8	58	21	19	2.2	0	334	11	0.4	0.9	473	327	327	112
Apr. 18, 1945	4,960	55	3	4.25	13.4	4.8	1.0	.02	.2	9.0	3.1	2.8	1.4	0	45	3.4	.1	.3	74	44	44	15
								Equivalents per million														
Aug. 11, 1944	---	---	---	---	---	---	1.046	.050	.066	2.895	1.727	.826	.056	.000	6.954	.310	.021	.015	---	---	---	---
Apr. 18, 1945	---	---	---	---	---	---	.111	.001	.007	.449	.255	.122	.036	.000	.937	.096	.005	.005	---	---	---	---

39. West Branch Susquehanna River at Williamsport

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
July 19, 1944	1,550	76	3	6.8	20.4	4.0	---	---	---	21	7.0	5.6		14	71	5.1	0.0	0.9	130	81	70	---
Mar. 22, 1945	55,000	44	5	6.1	5.83	4.6	---	0.04	0.0	5.8	1.8	2.2		7	17	1.1	.1	1.6	39	22	16	---
								Equivalents per million														
July 19, 1944	---	---	---	---	---	---	---	---	---	1.048	.576	.243		.230	1.478	.144	.000	.015	---	---	---	---
Mar. 22, 1945	---	---	---	---	---	---	---	---	---	.289	.148	.094		.115	.354	.031	.005	.026	---	---	---	---

40. West Branch Susquehanna River at Lewisburg

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Oct. 11-20, 1944	1,920	58	5	6.5	26.0	4.4	---	0.01	0.2	27	8.3	9.7	1.9	8	96	7.0	0.1	1.4	166	102	95	---
Mar. 21-31, 1945	39,200	50	3	5.7	8.39	4.3	---	.02	.0	8.5	2.7	1.8	.6	3	29	1.8	.1	1.0	54	32	30	---
								Equivalents per million														
Oct. 11-20, 1944	---	---	---	---	---	---	---	---	---	1.348	.683	.422	.049	.131	1.999	.197	.005	.023	---	---	---	---
Mar. 21-31, 1945	---	---	---	---	---	---	---	---	---	.424	.222	.078	.015	.049	.604	.051	.005	.016	---	---	---	---

41. Clearfield Creek at Dimeling

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 8, 1944	110	80	8	3.1	65.3	8.4	5.8	0.35	1.6	37	14	---		0	212	1.8	0.2	0.0	331	224	224	78
Apr. 16, 1945	568	55	3	3.5	34.7	7.5	3.0	.18	.6	19	7.1	2.6	1.1	0	113	2.0	.2	.8	162	111	111	44
								Equivalents per million														
Aug. 8, 1944	---	---	---	---	---	---	.645	.019	.058	1.847	1.151	---		.000	4.414	.051	.011	.000	---	---	---	---
Apr. 16, 1945	---	---	---	---	---	---	.334	.010	.022	.948	.584	.113	.028	.000	2.353	.056	.011	.013	---	---	---	---

Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

SUSQUEHANNA RIVER BASIN--Continued

42. Moshannon Creek at Osceola Mills

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Picarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 7, 1944	65.9	76	5	2.8	121	12	18	2.9	2.8	49	21	6.2		0	393	2.2	0.2	0.1	636	399	399	227
Aug. 10, 1944	18.0	71	5	2.6	170	20	23	11	3.4	71	29	18		0	593	3.1	---	1.0	797	584	584	342
Apr. 16, 1945	116	50	4	2.95	78.8	9.8	7.9	2.3	1.6	30	13	1.7	1.4	0	236	1.4	.2	.4	349	245	245	62
								Equivalents per million														
Aug. 7, 1944	---	---	---	---	---	---	2.002	.156	.102	2.446	1.727	.271		.000	8.182	.062	.011	.002	---	---	---	---
Aug. 10, 1944	---	---	---	---	---	---	2.558	.591	.124	3.544	2.385	.767		.000	12.346	.087	---	.016	---	---	---	---
Apr. 16, 1945	---	---	---	---	---	---	.879	.124	.058	1.497	1.069	.074	.036	.000	4,913	.039	.011	.006	---	---	---	---

43. Sinnemahoning Creek at Sinnemahoning

								Parts per million														
Aug. 10, 1944	39.8	77	5	3.8	33.5	11	6.1	0.14	0.9	22	9.2	6.6		0	126	12	0.2	1.0	205	135	135	59
May 23, 1945	1,490	58	5	7.3	5.94	3.4	---	.05	.0	5.8	1.8	2.3		6	18	1.8	.1	.4	35	22	17	---
								Equivalents per million														
Aug. 10, 1944	---	---	---	---	---	---	.678	.008	.033	1.098	.757	.287		.000	2.623	.338	.011	.016	---	---	---	---
May 23, 1945	---	---	---	---	---	---	---	---	---	.289	.148	.098		.098	.375	.051	.005	.006	---	---	---	---

44. Driftwood Branch Sinnemahoning Creek at Sterling Run

								Parts per million														
Aug. 9, 1944	15.1	85	5	7.1	13.0	3.0	---	0.02	---	12	2.6	8.5		20	22	13	0.1	1.6	75	41	12	---
Apr. 17, 1945	348	57	8	6.8	5.89	3.4	---	.04	0.0	6.0	1.8	2.2		10	15	2.2	.0	.4	36	22	14	---
								Equivalents per million														
Aug. 9, 1944	---	---	---	---	---	---	---	---	---	.599	.214	.371		.328	.458	.367	.005	.026	---	---	---	---
Apr. 17, 1945	---	---	---	---	---	---	---	---	---	.299	.148	.097		.164	.312	.062	.000	.006	---	---	---	---

45. Kettle Creek near Cross Fork

								Parts per million														
Aug. 11, 1944	7.82	73	10	6.8	6.00	3.1	---	0.01	---	6.5	1.8	1.7		20	7.9	1.8	0.0	0.2	32	24	7	---
Apr. 18, 1945	142	47	9	6.6	4.12	2.8	---	.03	0.0	4.6	1.3	1.9		14	7.1	.8	.1	1.0	25	17	5	---
								Equivalents per million														
Aug. 11, 1944	---	---	---	---	---	---	---	---	---	.324	.148	.074		.328	.164	.051	.000	.003	---	---	---	---

46. North Bald Eagle Creek at Beech Creek Station

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 12, 1944	167	70	9	7.8	32.8	2.7	---	0.02	---	40	16	2.0		176	14	5.0	0.0	5.0	188	166	21	---
Apr. 18, 1945	903	55	8	7.6	19.9	4.5	---	.03	0.0	26	8.2	2.3		96	17	2.8	.0	4.1	112	99	20	---
								Equivalents per million														
Aug. 12, 1944	---	---	---	---	---	---	---	---	---	1.997	1.316	.085		2.885	.291	.141	.000	.081	---	---	---	---
Apr. 18, 1945	---	---	---	---	---	---	---	---	---	1.298	.674	.101		1.574	.354	.079	.000	.066	---	---	---	---

47. Spring Creek near Axemann

								Parts per million														
Aug. 10, 1944	54.3	69	5	8.4	33.9	3.3	---	0.02	---	44	18	1.0		[a]197	12	3.2	0.0	9.4	198	184	22	---
Apr. 18, 1945	115	53	7	7.8	33.7	3.8	---	.05	0.0	45	16	1.3		190	13	2.8	.0	9.6	182	178	22	---
								Equivalents per million														
Aug. 10, 1944	---	---	---	---	---	---	---	---	---	2.196	1.480	.045		3.229	.250	.090	.000	.152	---	---	---	---
Apr. 18, 1945	---	---	---	---	---	---	---	---	---	2.246	1.316	.057		3.114	.271	.079	.000	.155	---	---	---	---

48. Thompson Spring at State College

								Parts per million														
Aug. 12, 1944	8.32	50	5	7.6	38.6	5.3	---	0.02	---	47	21	3.2		227	10	3.2	0.0	12	221	204	18	---
								Equivalents per million														
Aug. 12, 1944	---	---	---	---	---	---	---	---	---	2.346	1.727	.140		3.721	.208	.090	.000	.194	---	---	---	---

49. Rock (Benner) Spring near Bellefonte

								Parts per million														
Aug. 12, 1944	16.2	50	4	7.8	28.7	5.4	---	0.02	---	37	14	2.9		171	5.8	1.9	0.0	9.2	162	150	10	---
								Equivalents per million														
Aug. 12, 1944	---	---	---	---	---	--	---	---	---	1.847	1.151	.128		2.803	.121	.054	.000	.148	---	---	---	---

[a] Includes equivalent of 10 parts per million of carbonate (CO_3).

Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

SUSQUEHANNA RIVER BASIN--Continued

50. Forked Spring at Fisherman's Paradise near Bellefonte

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 12, 1944-----	5.72	53	3	7.3	30.7	6.4	---	0.02	---	46	19	4.1		220	11	2.5	0.1	7.7	207	193	13	---
								Equivalents per million														
Aug. 12, 1944-----	---	---	---	---	---	---	---	---	---	2.296	1.562	.177		3.606	.229	.071	.005	.124	---	---	---	---

51. Kelly Spring near Bellefonte

								Parts per million														
Aug. 12, 1944-----	15.5	50	5	7.7	27.2	6.0	---	0.08	---	32	14	4.8		161	5.8	4.5	0.1	4.1	150	137	5	---
								Equivalents per million														
Aug. 12, 1944-----	---	---	---	---	---	---	---	---	---	1.597	1.151	.210		2.639	.121	.127	.005	.066	---	---	---	---

52. Pine Creek at Cedar Run

								Parts per million														
Aug. 30, 1944-----	53.1	68	4	7.2	13.6	2.4	---	0.02	---	14	3.3	6.1		25	26	7.5	1.2	0.6	75	48	28	---
Mar. 27, 1945-----	2,240	49	10	6.5	5.80	4.3	---	.14	0.1	6.0	1.6	2.1		8	16	1.4	.1	1.0	38	22	15	---
								Equivalents per million														
Aug. 30, 1944-----	---	---	---	---	---	---	---	---	---	.699	.271	.266		.410	.541	.212	.063	.010	---	---	---	---
Mar. 27, 1945-----	---	---	---	---	---	---	---	---	---	.300	.132	.092		.131	.333	.039	.005	.016	---	---	---	---

53. Blockhouse Creek near English Center

								Parts per million														
Aug. 30, 1944-----	2.91	65	6	7.3	6.68	3.3	---	0.02	---	8.2	1.3	2.9		24	8.9	2.0	0.1	0.2	37	26	6	---
Mar. 27, 1945-----	127	48	6	6.6	4.84	4.4	---	.02	0.0	5.6	1.0	1.6		10	10	1.0	.1	1.6	31	18	10	---
								Equivalents per million														
Aug. 30, 1944-----	---	---	---	---	---	---	---	---	---	.409	.107	.126		.393	.185	.056	.005	.003	---	---	---	---
Mar. 27, 1945-----	---	---	---	---	---	---	---	---	---	.280	.082	.069		.164	.208	.028	.005	.026	---	---	---	---

54. Lycoming Creek near Trout Run

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
July 20, 1944	38.3	63	3	6.9	6.59	3.4	---	---	---	7.5	1.7	1.9		15	14	1.5	0.1	0.7	40	26	13	---
Mar. 27, 1945	572	49	4	6.5	4.39	3.6	---	0.01	0.0	4.6	1.2	2.6		10	11	1.0	0	1.4	29	16	8	---
								Equivalents per million														
July 20, 1944	---	---	---	---	---	---	---	---	---	.374	.140	.082		.246	.292	.042	.005	.011	---	---	---	---
Mar. 27, 1945	---	---	---	---	---	---	---	---	---	.230	.099	.115		.164	.229	.028	.000	.023	---	---	---	---

55. Loyalsock Creek at Loyalsock

								Parts per million														
July 20, 1944	103	68	4	7.0	5.08	3.0	---	---	---	6.0	1.4	1.1		13	10	1.2	0.0	0.5	31	21	10	---
Mar. 28, 1945	1,360	49	5	6.7	4.11	3.2	---	0.01	0.0	4.5	1.0	1.4		7	10	1.0	.0	.9	28	15	10	---
								Equivalents per million														
July 20, 1944	---	---	---	---	---	---	---	---	---	.299	.115	.049		.213	.208	.034	.000	.008	---	---	---	---
Mar. 28, 1945	---	---	---	---	---	---	---	---	---	.225	.082	.059		.115	.208	.028	.000	.015	---	---	---	---

56. Muncy Creek at Sonestown

								Parts per million														
Aug. 31, 1944	2.01	66	7	7.1	4.54	3.0	-	0.02	---	5.6	1.0	1.6		13	7.6	1.8	0.1	0.2	26	18	7	---
Mar. 28, 1945	67.8	50	8	6.4	3.51	3.8	---	.01	0.0	4.0	.8	1.7		7	7.4	.9	.1	1.4	24	13	8	---
								Equivalents per million														
Aug. 31, 1944	---	---	---	---	---	---	---	---	---	.280	.082	.068		.213	.158	.051	.005	.003	---	---	---	---
Mar. 28, 1945	---	---	---	---	---	---	---	---	---	.200	.066	.075		.115	.154	.023	.005	.023	---	---	---	---

57. Penn Creek at Penns Creek

								Parts per million														
July 17, 1944	202	80	5	8.6	15.0	2.0	---	---	---	24	4.8	---		[a]80	9.0	1.1	0.0	0.8	88	80	14	---
Mar. 15, 1945	1,000	44	10	7.5	13.9	4.9	---	0.05	0.0	21	5.1	2.2		66	11	1.2	.0	3.4	81	65	11	---
								Equivalents per million														
July 17, 1944	---	---	---	---	---	---	---	---	---	1.198	.395	---		1.311	.187	.031	.000	.013	---	---	---	---
Mar. 15, 1945	---	---	---	---	---	---	---	---	---	1.048	.255	.097		1.082	.229	.064	.000	.054	---	---	---	---

[a] Less than equivalent of 5 parts per million of carbonate (CO_3).

PROCEDURE
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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

SUSQUEHANNA RIVER BASIN--Continued

58. Shamokin Creek at Weight Scale

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 8, 1944	69.2	76	8	3.0	178	21	29	15	10	119	68	17		0	817	22	0.1	0.4	1,260	845	845	342
Mar. 16, 1945	141	55	5	2.75	210	20	19	8.3	10	148	82	8.6	2.1	0	994	3.2	.2	.3	1,430	957	957	276
								Equivalents per million														
Aug. 8, 1944	---	---	---	---	---	---	3.266	.806	.364	5.940	5.592	.745		.000	17.010	.620	.005	.006	---	---	---	---
Mar. 16, 1945	---	---	---	---	---	---	2.113	.446	.364	7.387	6.743	.374	.054	.000	20.695	.090	.011	.005	---	---	---	---

59. Mahantango Creek East near Dalmatia

								Parts per million														
July 30, 1944	35.3	81	5	4.6	18.6	5.7	1.0	0.03	1.9	13	9.5	1.8		0	79	0.8	0.1	1.2	120	81	81	6
Mar. 16, 1945	269	55	1	4.3	11.8	5.9	.4	.03	.3	7.0	4.6	2.2	0.9	0	35	1.6	.1	5.4	65	41	41	8
								Equivalents per million														
July 30, 1944	---	---	---	---	---	---	.111	.002	.069	.649	.781	.080		.000	1.645	.023	.005	.019	---	---	---	---
Mar. 16, 1945	---	---	---	---	---	---	.044	.002	.011	.349	.378	.096	.023	.000	.729	.045	.005	.087	---	---	---	---

60. Frankstown Branch Juniata River at Williamsburg

								Parts per million														
Aug. 9, 1944	85.3	83	160	7.3	43.8	5.2	---	0.08	---	46	14	23		164	64	13	---	4.8	268	172	38	---
Apr. 17, 1945	550	56	7	7.4	22.6	4.9	---	.02	---	24	8.9	5.3	1.2	70	36	6.5	0.1	4.9	130	96	39	---
								Equivalents per million														
Aug. 9, 1944	---	---	---	---	---	---	---	---	---	2.296	1.151	1.017		2.688	1.332	.367	---	.077	---	---	---	---
Apr. 17, 1945	---	---	---	---	---	---	---	---	---	1.198	.732	.230	.031	1.147	.750	.183	.005	.079	---	---	---	---

61. Frankstown Branch Juniata River at Huntingdon

								Parts per million														
Aug. 9, 1944	200	78	160	7.5	40.2	5.1	---	0.35	---	42	14	18		174	32	18	0.2	0.4	241	162	20	---
May 17, 1945	1,860	64	20	7.3	20.2	4.7	---	.03	0.0	24	6.5	6.1		77	24	5.9	.2	3.7	113	87	24	---
								Equivalents per million														
Aug. 9, 1944	---	---	---	---	---	---	---	---	---	2.096	1.151	.796		2.852	.666	.508	.011	.006	---	---	---	---
May 17, 1945																						

62. Juniata River at Newport

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Oct. 11-20, 1944	689	55	40	7.6	41.5	2.6	---	0.11	0.0	40	13	26	2.8	124	92	13	0.2	1.4	252	153	52	---
Mar. 21-31, 1945	9,380	54	20	7.1	15.1	6.3	---	.16	.0	18	4.8	3.7	1.0	49	24	3.1	.1	4.1	95	65	24	---
								Equivalents per million														
Oct. 11-20, 1944	---	---	---	---	---	---	---	---	---	1.997	1.069	1.131	.072	2.032	1.915	.367	.011	.023	---	---	---	---
Mar. 21-31, 1945	---	---	---	---	---	---	---	---	---	.898	.395	.161	.026	.803	.500	.087	.005	.066	---	---	---	---

63. Little Juniata River at Spruce Creek

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 10, 1944	79.5	64	260	7.3	47.3	6.1	---	0.08	---	40	14	42		178	43	40	---	1.0	298	157	11	---
Apr. 17, 1945	353	54	60	7.2	22.9	5.0	---	.03	---	24	6.6	12	1.3	78	27	15	0.2	1.9	136	87	23	---
								Equivalents per million														
Aug. 10, 1944	---	---	---	---	---	---	---	---	---	1.997	1.151	1.819		2.918	.895	1.128	---	.016	---	---	---	---
Apr. 17, 1945	---	---	---	---	---	---	---	---	---	1.198	.543	.522	.033	1.278	.562	.423	.011	.031	---	---	---	---

64. Little Bald Eagle Creek at Tyrone

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 10, 1944	11.5	89	360	6.7	83.8	6.2	---	0.03	---	72	12	75		96	77	165	---	0.0	564	229	150	---
Apr. 17, 1945	116	54	45	6.7	14.0	5.0	---	.01	---	13	2.9	9.0	1.1	26	19	17	0.2	.2	88	44	23	---
								Equivalents per million														
Aug. 10, 1944	---	---	---	---	---	---	---	---	---	3.594	.987	3.260		1.574	1.603	4.654	---	.000	---	---	---	---
Apr. 17, 1945	---	---	---	---	---	---	---	---	---	.649	.239	.391	.028	.426	.396	.480	.011	.003	---	---	---	---

65. Arch Spring at Arch Spring

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 10, 1944	16.8	54	3	7.3	25.0	6.8	---	0.04	---	37	9.1	---		132	15	1.6	0.1	4.7	141	130	24	---
								Equivalents per million														
Aug. 10, 1944	---	---	---	---	---	---	---	---	---	1.847	.748	---		2.164	.312	.045	.005	.076	---	---	---	---

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

SUSQUEHANNA RIVER BASIN--Continued

66. Standing Stone Creek near Huntingdon

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10^6 at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 9, 1944	16.1	78	5	7.9	18.8	3.4	---	0.03	---	25	7.3	1.9		90	20	0.9	0.1	0.6	102	92	19	---
May 17, 1945	502	61	31	7.1	8.46	5.6	---	.10	---	10	2.9	2.5		34	11	1.2	.2	.8	55	37	9	---
								Equivalents per million														
Aug. 9, 1944	---	---	---	---	---	---	---	---	---	1.248	.600	.083		1.475	.416	.025	.005	.010	---	---	---	---
May 17, 1945	---	---	---	---	---	---	---	---	---	.499	.238	.107		.557	.229	.034	.011	.013	---	---	---	---

67. Raystown Branch Juniata River at Saxton

								Parts per million														
Aug. 9, 1944	84.4	78	5	7.9	30.0	2.1	---	0.04	---	39	16	9.2		120	53	1.9	0.2	2.9	180	163	65	---
Apr. 19, 1945	1,460	50	27	7.3	11.8	6.7	---	.13	0.0	14	4.0	2.4		40	19	1.6	.1	2.0	75	51	19	---
								Equivalents per million														
Aug. 9, 1944	---	---	---	---	---	---	---	---	---	1.947	1.316	.401		1.967	1.103	.536	.011	.047	---	---	---	---
Apr. 19, 1945	---	---	---	---	---	---	---	---	---	.699	.329	.106		.656	.396	.045	.005	.032	---	---	---	---

68. Dunning Creek at Belden

								Parts per million														
Aug. 9, 1944	16.6	76	4	8.0	28.9	3.8	---	0.01	---	42	12	---		[a]106	59	1.5	0.1	2.0	176	154	67	---
Apr. 19, 1945	211	51	9	7.4	11.3	5.8	---	.03	0.0	14	3.8	2.4		39	18	1.8	.1	2.9	67	51	19	---
								Equivalents per million														
Aug. 9, 1944	---	---	---	---	---	---	---	---	---	2.096	.987	---		1.737	1.228	.042	.005	.032	---	---	---	---
Apr. 19, 1945	---	---	---	---	---	---	---	---	---	.699	.312	.106		.639	.375	.051	.005	.047	---	---	---	---

69. Brush Creek at Gapsville

								Parts per million														
Aug. 9, 1944	2.34	69	10	6.9	6.96	3.5	---	0.19	---	9.0	1.8	0.7		24	6.5	1.5	0.1	3.2	44	30	10	---
Apr. 19, 1945	88.3	49	8	6.5	2.72	4.7	---	.06	0.0	3.2	.9	1.4		9	5.3	1.1	.0	.4	21	12	4	---
								Equivalents per million														
Aug. 9, 1944	---	---	---	---	---	---	---	---	---	.449	.148	.030		.393	.135	.042	.005	.052	---	---	---	---
Apr. 19, 1945	---	---	---	---	---	---	---	---	---	.160	.074	.061		.148	.110	.031	.000	.006	---	---	---	---

[a] Includes 4 parts per million of carbonate (CO_3).

SUSQUEHANNA RIVER BASIN--Continued

70. Great Trough Creek near Marklesburg

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (K x 10^6 at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
									Parts per million													
Aug. 9, 1944	2.0	70	4	3.6	56.4	14	9.8	0.38	2.3	52	18	---		0	255	1.5	0.3	1.0	386	274	274	91
Apr. 12, 1945	265	51	6	3.95	14.9	5.9	1.1	.11	.2	9.2	3.2	1.7	1.0	0	47	.6	.1	.6	74	48	48	18
									Equivalents per million													
Aug. 9, 1944	---	---	---	---	---	---	1.090	.020	.084	2.595	1.480		---	.000	5.371	.042	.016	.016	---	---	---	---
Apr. 12, 1945	---	---	---	---	---	---	.132	.006	.007	.459	.263	.074	.024	.000	.978	.017	.005	.010	---	---	---	---

71. Aughwick Creek near Three Springs

									Parts per million													
Aug. 10, 1944	.1	71	5	7.8	20.4	1.2	---	0.01	---	20	7.1	1.3		102	18	1.2	0.1	0.2	112	102	18	---
May 18, 1945	2,080	63	30	6.2	9.09	5.7	---	.04	0.0	6.0	1.5	1.1		14	9.4	.9	.2	.6	45	21	10	---
									Equivalents per million													
Aug. 10, 1944	---	---	---	---	---	---	---	---	---	1.447	.584	.058		1.672	.375	.034	.005	.003	---	---	---	---
May 18, 1945	---	---	---	---	---	---	---	---	---	.300	.123	.049		.230	.196	.025	.011	.010	---	---	---	---

72. Kishacoquillas Creek at Reedsville

									Parts per million													
Aug. 10, 1944	50.2	69	5	8.0	27.6	4.7	---	0.02	---	35	11	5.8		146	16	2.0	0.0	7.5	156	133	13	---
May 28, 1945	490	59	10	7.9	17.7	6.9	---	.05	0.0	24	5.7	3.2		85	11	3.0	.1	5.8	100	93	14	---
									Equivalents per million													
Aug. 10, 1944	---	---	---	---	---	---	---	---	---	1.747	.905	.251		2.393	.333	.056	.000	.121	---	---	---	---
May 28, 1945	---	---	---	---	---	---	---	---	---	1.198	.469	.139		1.393	.229	.085	.005	.094	---	---	---	---

73. Tuscarora Creek near Port Royal

									Parts per million													
Aug. 10, 1944	8.6	81	8	7.8	21.7	0.4	---	0.03	---	30	8.5	4.5		118	19	1.6	0.2	0.4	123	110	13	---
May 28, 1945	250	61	10	7.9	11.6	5.6	---	.04	0.0	16	3.6	1.9		53	11	1.5	.1	1.9	67	55	11	---
									Equivalents per million													
Aug. 10, 1944	---	---	---	---	---	---	---	---	---	1.497	.699	.196		1.934	.396	.045	.011	.006	---	---	---	---
May 28, 1945	---	---	---	---	---	---	---	---	---	.799	.296	.081		.669	.229	.042	.005	.031	---	---	---	---

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

SUSQUEHANNA RIVER BASIN--Continued

74. Cocolamus Creek near Millerstown

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 10, 1944	4.6	76	13	7.1	16.8	3.3	---	0.02	---	25	4.9	0.6		78	14	2.1	0.1	2.7	97	83	19	---
May 29, 1945	670	54	18	6.6	5.69	5.3	---	.03	0.0	6.0	1.6	2.4		16	9.3	1.2	.2	2.2	41	22	8	---
								Equivalents per million														
Aug. 10, 1944	---	---	---	---	---	---	---	---	---	1.248	.403	.027		1.279	.291	.059	.005	.044	---	---	---	---
May 29, 1945	---	---	---	---	---	---	---	---	---	.300	.132	.104		.262	.194	.034	.011	.035	---	---	---	---

75. Sherman Creek at Shermandale

								Parts per million														
July 14, 1944	32.6	85	6	8.4	16.8	2.3	---	---	---	24	5.9	1.4		[a]86	13	1.6	0.1	0.9	100	84	14	---
Mar. 23, 1945	638	44	15	7.3	9.94	6.5	---	0.10	0.0	14	2.4	1.4		40	10	1.4	.1	3.1	61	45	12	---
								Equivalents per million														
July 14, 1944	---	---	---	---	---	---	---	---	---	1.198	.485	.063		1.410	.271	.045	.005	.015	---	---	---	---
Mar. 23, 1945	---	---	---	---	---	---	---	---	---	.699	.197	.062		.656	.208	.039	.005	.050	---	---	---	---

76. Clark Creek near Carsonville

								Parts per million														
Aug. 23, 1944	7.41	51	14	6.1	2.34	3.5	---	0.46	0.0	2.2	0.6	2.6		9	4.1	1.0	0.1	0.4	20	8	0	---
Mar. 20, 1945	6.38	44	7	6.0	2.55	4.1	---	.04	.0	2.5	.6	2.5		9	4.8	1.1	.0	.2	19	9	1	---
								Equivalents per million														
Aug. 23, 1944	---	---	---	---	---	---	---	---	---	.110	.049	.113		.148	.085	.028	.005	.000	---	---	---	---
Mar. 20, 1945	---	---	---	---	---	---	---	---	---	.125	.049	.108		.148	.100	.031	.000	.002	---	---	---	---

77. Stony Creek near Dauphin

								Parts per million														
Aug. 23, 1944	7.91	70	8	7.0	3.22	4.2	---	0.02	---	3.4	0.8	2.5		15	2.7	1.1	0.1	0.3	22	12	0	---
Mar. 20, 1945	75.8	52	10	6.5	2.40	4.9	---	.02	0.0	2.2	.8	2.1		7	5.5	1.2	.0	.2	20	9	3	---
								Equivalents per million														
Aug. 23, 1944	---	---	---	---	---	---	---	---	---	.170	.066	.107		.246	.056	.031	.005	.005	---	---	---	---
Mar. 20, 1945	---	---	---	---	---	---	---	---	---	.110	.066	.091		.115	.115	.034	.000	.003	---	---	---	---

SUSQUEHANNA RIVER BASIN--Continued

78. Conodoguinet Creek at Hogestown

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
										Parts per million												
July 14, 1944	221	84	6	8.0	20.0	2.6	---	---	---	44	9.1	2.5		140	13	6.2	0.1	7.2	178	137	26	---
Mar. 23, 1945	910	47	25	7.4	19.5	9.8	---	0.24	0.0	28	5.1	3.7		88	16	2.9	.1	7.1	120	91	19	---
										Equivalents per million												
July 14, 1944	---	---	---	---	---	---	---	---	---	2.196	.748	.107		2.426	.312	.192	.005	.110	---	---	---	---
Mar. 23, 1945	---	---	---	---	---	---	---	---	---	1.398	.419	.159		1.442	.333	.082	.005	.114	---	---	---	---

79. Big Spring near Newville

										Parts per million												
Aug. 4, 1944	28.6	50	4	7.6	30.6	6.5	---	0.02	---	50	7.9	0.4		167	9.5	1.4	0.2	11	172	157	20	---
										Equivalents per million												
Aug. 4, 1944	---	---	---	---	---	---	---	---	---	2.496	.650	.016		2.737	.198	.039	.011	.177	---	---	---	---

80. Paxton Creek near Pembrook

										Parts per million												
Aug. 10, 1944	0.60	76	20	7.4	22.5	7.7	---	0.23	---	34	4.1	3.9		96	19	3.2	0.2	8.2	140	102	23	---
Mar. 21, 1945	11.0	58	20	7.1	15.0	9.0	---	.01	0.0	19	3.8	5.7		52	23	2.6	.2	5.5	95	63	20	---
										Equivalents per million												
Aug. 10, 1944	---	---	---	---	---	---	---	---	---	1.697	.337	.169		1.574	.396	.090	.011	.132	---	---	---	---
Mar. 21, 1945	---	---	---	---	---	---	---	---	---	.948	.312	.249		.852	.479	.073	.016	.089	---	---	---	---

81. Yellow Breeches Creek at Olmstead Mill

										Parts per million												
Aug. 25, 1944	133	64	10	6.8	25.1	7.6	---	0.04	---	35	9.9	0.9		138	8.9	2.2	0.0	5.6	145	128	15	---
May 31, 1945	670	60	12	7.7	15.4	8.0	---	.05	0.0	20	5.3	2.8		73	11	2.1	.1	4.1	88	72	12	---
										Equivalents per million												
Aug. 25, 1944	---	---	---	---	---	---	---	---	---	1.747	.814	.038		2.262	.185	.062	.000	.090	---	---	---	---
May 31, 1945	---	---	---	---	---	---	---	---	---	.998	.436	.122		1.197	.229	.059	.005	.065	---	---	---	---

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

SUSQUEHANNA RIVER BASIN--Continued

82. Boiling Springs at Boiling Springs

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 4, 1944	34.8	53	3	7.5	22.5	8.9	---	0.01	---	31	9.3	0.3		124	7.0	1.2	0.2	7.2	125	116	14	---
								Equivalents per million														
Aug. 4, 1944	---	---	---	---	---	---	---	---	---	1.547	.765	.027		2.032	.146	.034	.011	.116	---	---	---	---

83. Swatara Creek at Harper Tavern

								Parts per million														
Aug. 23, 1944	39.8	69	6	7.7	28.6	6.4	---	0.02	---	27	10	10		36	83	8.5	0.1	3.2	176	108	79	---
Mar. 21, 1945	930	56	10	6.5	11.1	6.3	---	.06	0.0	11	3.7	4.0		23	24	3.0	.0	4.0	70	43	24	---
								Equivalents per million														
Aug. 23, 1944	---	---	---	---	---	---	---	---	---	1.348	.822	.445		.590	1.728	.240	.005	.052	---	---	---	---
Mar. 21, 1945	---	---	---	---	---	---	---	---	---	.549	.304	.173		.377	.500	.085	.000	.064	---	---	---	---

84. West Conewago Creek near Manchester

								Parts per million														
Aug. 22, 1944	15.4	77	10	7.1	17.1	3.3	---	0.02	---	20	5.2	6.1		74	13	6.5	0.1	1.2	98	71	11	---
Mar. 22, 1945	704	53	8	7.5	14.2	10	---	.04	0.0	16	4.4	4.1		48	17	3.9	.1	5.2	87	58	19	---
								Equivalents per million														
Aug. 22, 1944	---	---	---	---	---	---	---	---	---	.998	.428	.265		1.213	.271	.183	.005	.019	---	---	---	---
Mar. 22, 1945	---	---	---	---	---	---	---	---	---	.799	.332	.179		.787	.354	.110	.005	.084	---	---	---	---

85. Codorus Creek near York

								Parts per million														
Aug. 22, 1944	24.0	71	1,200	7.3	85.9	5.8	---	0.09	---	35	6.6	169		400	29	68	---	0.2	698	114	0	---
Mar. 22, 1945	321	53	35	6.7	19.0	5.3	---	.02	0.0	18	4.5	13		66	14	12	0.1	7.2	114	63	9	---
								Equivalents per million														
Aug. 22, 1944	---	---	---	---	---	---	---	---	---	1.747	.543	7.356		6.557	.604	2.482	---	.003	---	---	---	---
Mar. 22, 1945	---	---	---	---	---	---	---	---	---	.898	.370	.564		1.081	.292	.338	.005	.116	---	---	---	---

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

SUSQUEHANNA RIVER BASIN--Continued

86. South Branch Codorus Creek near York

Date of collection	Discharge (second-feet)	Temperature (°F)	Color	pH	Specific conductance (Kx10^6 at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 22, 1944	2.1	77	8	6.7	10.5	3.1	---	0.01	---	9.5	3.0	4.5		34	5.1	6.8	0.1	3.4	58	36	8	---
Mar. 22, 1945	196	53	10	6.3	9.76	3.4	---	.02	0.0	8.3	2.9	4.8		21	8.9	5.5	.0	11	64	33	15	---
								Equivalents per million														
Aug. 22, 1944	---	---	---	---	---	---	---	---	---	.474	.247	.194		.557	.106	.192	.005	.055	---	---	---	---
Mar. 22, 1945	---	---	---	---	---	---	---	---	---	.414	.238	.209		.344	.185	.155	.000	.177	---	---	---	---

87. Conestoga Creek at Lancaster

								Parts per million														
July 24, 1944	119	74	8	7.8	34.9	6.5	---	0.04	---	48	14	---		175	19	4.5	0.1	6.9	203	177	34	---
Apr. 2, 1945	407	58	13	6.3	30.8	4.6	---	.38	0.0	41	7.3	14		153	18	5.0	.0	15	184	132	7	---
								Equivalents per million														
July 24, 1944	---	---	---	---	---	---	---	---	---	2.396	1.151	---		2.868	.396	.127	.005	.111	---	---	---	---
Apr. 2, 1945	---	---	---	---	---	---	---	---	---	2.046	.600	.620		2.508	.375	.141	.000	.242	---	---	---	---

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

OHIO RIVER BASIN

88. Allegheny River at Eldred

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10^6 at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
										Parts per million												
Aug. 25, 1944	71	64	6	7.0	74.9	2.9	---	0.02	---	42	9.4	84		48	11	194	0.1	0.6	418	143	104	---
Apr. 14, 1945	930	58	10	6.9	15.2	3.4	---	.05	0.0	10	2.4	15		17	9.9	30	.2	.9	90	35	21	---
										Equivalents per million												
Aug. 25, 1944	---	---	---	---	---	---	---	---	---	2.096	.773	3.633		.787	.229	5.471	.005	.010	---	---	---	---
Apr. 14, 1945	---	---	---	---	---	---	---	---	---	.499	.197	.661		.279	.206	.846	.011	.015	---	---	---	---

89. Allegheny River near Kinzua

										Parts per million												
Aug. 12, 1944	320	81	7	7.5	51.0	1.6	---	0.17	---	36	6.6	52		78	18	104	0.3	0.3	282	117	53	---
Apr. 15, 1945	3,180	50	10	7.2	19.9	2.8	---	.03	0.0	15	3.3	18		35	14	33	.1	1.0	112	51	22	---
										Equivalents per million												
Aug. 12, 1944	---	---	---	---	---	---	---	---	---	1.797	.543	2.268		1.279	.375	2.933	.016	.005	---	---	---	---
Apr. 15, 1945	---	---	---	---	---	---	---	---	---	.749	.271	.798		.574	.292	.931	.005	.016	---	---	---	---

90. Allegheny River at West Hickory

										Parts per million												
Aug. 10, 1944	586	82	5	7.6	42.0	1.0	---	0.04	---	33	6.4	39		82	20	75	0.2	0.2	230	109	46	---
Apr. 12, 1945	8,260	60	9	7.1	14.3	3.1	---	.01	0.0	14	2.9	8.3		37	13	14	.2	1.0	79	47	17	---
										Equivalents per million												
Aug. 10, 1944	---	---	---	---	---	---	---	---	---	1.647	.526	1.716		1.344	.416	2.115	.011	.003	---	---	---	---
Apr. 12, 1945	---	---	---	---	---	---	---	---	---	.699	.238	.362		.606	.271	.395	.011	.016	---	---	---	---

91. Allegheny River near Rimer

										Parts per million												
Aug. 6, 1944	1,810	83	10	7.5	36.1	1.0	---	0.01	---	30	6.7	29		61	45	48	0.1	0.3	212	102	52	---
Apr. 8, 1945	42,800	55	18	6.7	9.68	4.3	---	.06	0.0	9.2	2.3	5.4		17	18	7.4	.1	1.0	60	32	18	---
										Equivalents per million												
Aug. 8, 1944	---	---	---	---	---	---	---	---	---	1.497	.551	1.253		1.000	.937	1.354	.005	.005	---	---	---	---
Apr. 8, 1945	---	---	---	---	---	---	---	---	---	.459	.189	.236		.279	.375	.209	.005	.016	---	---	---	---

OHIO RIVER BASIN--Continued

92. Allegheny River at Kittanning

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Oct. 11-20, 1944	3,200	57	15	7.2	37.6	0.6	---	0.08	0.0	32	6.8	29	2.9	58	58	46	0.0	0.4	215	108	60	---
Mar. 21-31, 1945	67,300	50	15	6.6	10.1	4.8	---	.09	.0	10	2.6	4.1	1.0	13	22	6.8	.2	1.0	64	36	25	---
								Equivalents per million														
Oct. 11-20, 1944	---	---	---	---	---	---	---	---	---	1.597	.559	1.261	.074	.951	1.208	1.297	.000	.006	---	---	---	---
Mar. 21-31, 1945	---	---	---	---	---	---	---	---	---	.499	.214	.178	.026	.213	.458	.192	.011	.016	---	---	---	---

93. Allegheny River at Natrona

								Parts per million														
Sept. 8, 1944	1,890	69	8	4.2	64.8	6.2	4.2	0.05	2.0	57	15	35		0	243	39	---	0.6	419	233	233	39
Mar. 31, 1945	37,000	54	2	5.3	16.4	5.1	---	.02	.4	15	4.4	7.3		5	54	7.0	0.1	1.2	100	56	51	---
								Equivalents per million														
Sept. 8, 1944	---	---	---	---	---	---	.467	.003	.073	2.845	1.234	1.516		.000	5.059	1.100	---	.010	---	---	---	---
Mar. 31, 1945	---	---	---	---	---	---	---	---	---	.749	.362	.316		.082	1.124	.197	.005	.019	---	---	---	---

94. Ohio River at Sewickley

								Parts per million														
Oct. 13, 1944	7,480	65	5	5.1	54.5	5.6	---	0.02	---	40	13	39		2	215	22	0.3	0.9	354	173	172	---
Mar. 27, 1945	90,400	54	4	4.70	19.8	5.4	0.7	.02	0.4	18	5.5	7.0	0.8	0	73	5.5	.4	1.5	122	72	72	7
								Equivalents per million														
Oct. 13, 1944	---	---	---	---	---	---	---	---	---	2.396	1.069	1.693		.033	4.476	.620	.016	.013	---	---	---	---
Mar. 27, 1945	---	---	---	---	---	---	.078	.001	.015	.898	.452	.304	.020	.000	1.520	.155	.021	.024	---	---	---	---

95. Conewango Creek at Russell

								Parts per million														
Aug. 12, 1944	145	78	12	7.5	27.5	3.0	---	0.02	---	38	6.6	10		131	23	6.4	0.2	4.4	160	122	15	---
May 29, 1945	532	64	13	7.0	19.1	1.9	---	.01	0.0	27	4.6	4.5		86	19	2.8	.1	2.0	109	86	16	---
								Equivalents per million														
Aug. 12, 1944	---	---	---	---	---	---	---	---	---	1.897	.543	.449		2.147	.479	.181	.011	.071	---	---	---	---
May 29, 1945	---	---	---	---	---	---	---	---	---	1.347	.378	.196		1.409	.396	.079	.005	.032	---	---	---	---

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

OHIO RIVER BASIN--Continued

96. Brokenstraw Creek at Youngsville

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 12, 1944	46	68	5	7.7	21.6	4.6	---	0.04	---	31	5.7	7.1		116	13	3.9	0.2	1.0	122	101	6	---
May 29, 1945	228	67	17	8.6	14.5	3.4	---	.02	0.0	20	4.0	3.5		[a]69	13	2.2	.1	1.0	84	66	10	---
								Equivalents per million														
Aug. 12, 1944	---	---	---	---	---	---	---	---	---	1.549	.469	.308		1.901	.271	.110	.011	.031	---	---	---	---
May 29, 1945	---	---	---	---	---	---	---	---	---	.998	.329	.157		1.131	.271	.062	.005	.016	---	---	---	---

97. Tionesta Creek at Mayburg

								Parts per million														
Aug. 11, 1944	31	74	10	7.2	12.9	1.3	---	0.01	---	9.6	2.9	12		44	7.8	12	0.0	0.4	70	36	0	---
May 25, 1945	475	59	16	6.4	5.06	2.9	---	.07	0.0	4.7	1.4	2.7		12	8.1	3.2	.1	.3	31	18	8	---
								Equivalents per million														
Aug. 11, 1944	---	---	---	---	---	---	---	---	---	.479	.238	.510		.721	.162	.338	.000	.006	---	---	---	---
May 25, 1945	---	---	---	---	---	---	---	---	---	.235	.115	.116		.197	.169	.090	.005	.005	---	---	---	---

98. Oil Creek at Rouseville

								Parts per million														
Aug. 10, 1944	45	73	10	7.3	33.1	1.0	---	0.01	---	31	7.6	21		85	20	45	0.1	0.2	186	109	39	---
Apr. 11, 1945	574	54	14	7.3	15.4	3.7	---	.05	0.0	14	3.3	11		36	13	20	.1	.4	93	48	19	---
								Equivalents per million														
Aug. 10, 1944	---	---	---	---	---	---	---	---	---	1.547	.625	.914		1.393	.416	1.269	.005	.003	---	---	---	---
Apr. 11, 1945	---	---	---	---	---	---	---	---	---	.699	.271	.466		.590	.271	.564	.005	.006	---	---	---	---

99. French Creek at Venango

								Parts per million														
Aug. 8, 1944	77	78	15	7.5	21.9	2.4	---	0.02	---	33	6.9	2.4		112	18	3.1	0.2	0.6	120	111	19	---
Apr. 17, 1945	545	56	18	7.5	16.5	1.7	---	.04	0.0	25	4.6	.9		74	18	1.8	.1	1.2	96	81	21	---
								Equivalents per million														
Aug. 8, 1944	---	---	---	---	---	---	---	---	---	1.647	.567	.105		1.836	.375	.087	.011	.010	---	---	---	---
Apr. 17, 1945	---	---	---	---	---	---	---	---	---	1.248	.378	.037		1.213	.375	.051	.005	.019	---	---	---	---

[a]Includes equivalent of 5 parts per million of carbonate (CO_3)

OHIO RIVER BASIN--Continued

100. French Creek at Utica

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 9, 1944	148	78	9	7.4	27.1	2.4	---	0.01	---	38	6.9	6.5		101	43	6.0	0.1	1.4	102	123	40	---
Apr. 19, 1945	926	49	21	7.6	20.8	1.5	---	.04	0.2	28	5.1	6.6		76	35	3.0	.0	2.6	126	91	29	---
								Equivalents per million														
Aug. 9, 1944	---	---	---	---	---	---	---	---	---	1.897	.567	.284		1.656	.895	.169	.005	.023	---	---	---	---
Apr. 19, 1945	---	---	---	---	---	---	---	---	---	1.396	.419	.285		1.246	.720	.085	.000	.042	---	---	---	---

101. Clarion River at Cooksburg

								Parts per million														
Aug. 14, 1944	74.5	79	85	6.6	66.0	5.2	---	0.01	---	71	9.1	47		9	134	68	0.2	0.4	431	215	133	---
Apr. 12, 1945	1,870	56	18	6.6	12.6	4.7	---	.22	0.0	12	2.9	5.8		8	34	8.5	.1	.2	64	42	35	---
								Equivalents per million														
Aug. 14, 1944	---	---	---	---	---	---	---	---	---	3.544	.748	2.056		1.623	2.790	1.918	.011	.006	---	---	---	---
Apr. 12, 1945	---	---	---	---	---	---	---	---	---	.599	.239	.250		.131	.708	.240	.005	.003	---	---	---	---

102. Clarion River at St. Petersburg

								Parts per million														
Aug. 14, 1944	44.4	87	60	7.0	36.0	2.4	---	0.74	---	35	6.5	26		43	77	38	0.2	0.5	232	144	79	---
Apr. 10, 1945	3,140	46	3	5.6	10.5	3.8	---	.03	0.2	3.2	3.3	3.2		2	33	4.8	.1	.6	65	36	35	---
								Equivalents per million														
Aug. 14, 1944	---	---	---	---	---	---	---	---	---	1.747	.535	1.117		.705	1.603	1.072	.011	.008	---	---	---	---
Apr. 10, 1945	---	---	---	---	---	---	---	---	---	.459	.271	.140		.033	.687	.135	.005	.010	---	---	---	---

103. Redbank Creek at St. Charles

								Parts per million														
Aug. 5, 1944	46	84	4	6.7	38.8	1.6	---	0.02	---	30	8.9	31		18	114	32	0.2	0.6	232	111	97	---
Apr. 8, 1945	2,160	50	4	4.8	11.7	5.4	---	.02	0.4	10	3.5	3.7		1	40	2.8	.1	.8	73	39	39	---
								Equivalents per million														
Aug. 5, 1944	---	---	---	---	---	---	---	---	---	1.497	.732	1.363		.295	2.373	.903	.011	.010	---	---	---	---
Apr. 8, 1945	---	---	---	---	---	---	---	---	---	.499	.288	.159		.016	.833	.079	.005	.013	---	---	---	---

Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

OHIO RIVER BASIN--Continued

104. Mahoning Creek at Punxsutawney

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 4, 1944	25	78	5	7.0	99.7	10	---	0.09	---	88	24	99		67	442	12	0.3	1.4	734	318	263	---
Apr. 7, 1945	697	44	1	5.9	26.2	6.4	---	.02	0.4	25	7.7	12	1.3	10	102	2.8	.1	1.8	168	94	86	---
								Equivalents per million														
Aug. 4, 1944	---	---	---	---	---	---	---	---	---	4.392	1.974	4.311		1.098	9.202	.338	.016	.023	---	---	---	---
Apr. 7, 1945	---	---	---	---	---	---	---	---	---	1.248	.633	.522	.033	.164	2.124	.078	.005	.029	---	---	---	---

105. Crooked Creek at Idaho

								Parts per million														
Aug. 3, 1944	15	80	2	3.9	94.9	10	4.6	0.11	---	60	23	90		0	399	38	0.2	0.6	652	275	275	40
Apr. 5, 1945	2,080	49	4	5.8	10.6	7.0	.4	.47	0.0	9.0	3.3	3.6	1.2	4	37	2.2	.1	1.8	72	39	36	9
								Equivalents per million														
Aug. 3, 1944	---	---	---	---	---	---	.512	.006	---	2.995	1.891	3.902		.000	8.307	1.072	.011	.010	---	---	---	---
Apr. 5, 1945	---	---	---	---	---	---	.044	.025	.000	.449	.271	.157	.031	.066	.770	.062	.005	.029	---	---	---	---

106. Stony Creek at Ferndale

								Parts per million														
Aug. 1, 1944	30	79	3	2.8	147	6.4	16	6.1	4.6	101	36	17		0	592	8.0	0.2	0.4	---	592	592	202
Apr. 3, 1945	1,560	55	1	3.65	26.0	3.9	2.0	.13	.6	16	5.5	1.4	1.2	0	86	1.2	.2	1.4	128	86	86	32
								Equivalents per million														
Aug. 1, 1944	---	---	---	---	---	---	1.780	.328	.168	5.041	2.960	.738		.000	12.325	.226	.011	.006	---	---	---	---
Apr. 3, 1945	---	---	---	---	---	---	.222	.007	.002	.799	.452	.061	.031	.000	1.790	.034	.011	.023	---	---	---	---

107. Conemaugh River at Seward

								Parts per million														
Aug. 2, 1944	241	80	4	3.9	96.7	14	2.1	0.27	9.2	103	28	38		0	444	18	0.5	0.8	682	406	406	40
Apr. 3, 1945	2,660	57	2	3.90	30.5	7.6	2.6	.06	1.9	25	7.4	3.5	2.3	0	119	3.2	.1	1.8	185	117	117	34
								Equivalents per million														
Aug. 2, 1944	---	---	---	---	---	---	.234	.015	.335	5.141	2.303	1.669		.000	9.244	.508	.026	.013	---	---	---	---
Apr. 3, 1945	---	---	---	---	---	---	.289	.003	.069	1.248	.609	.152	.059	.000	2.478	.090	.005	.029	---	---	---	---

109. Kiskiminetas River at Vandergrift

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Total acidity as H_2SO_4
									Parts per million													
Sept. 4, 1944	448	71	5	2.7	174	19	15	3.6	8.2	112	38	33	9.5	0	686	13	0.5	1.3	350	342	342	246
Mar. 31, 1945	3,420	42	3	3.10	72.4	13	9.0	.68	2.2	39	14	6.1	2.4	0	251	3.0	.2	2.2	345	264	264	102
									Equivalents per million													
Sept. 4, 1944	---	---	---	---	---	---	1.668	.064	.299	5.590	3.125	1.435	.243	.000	14.282	.451	.026	.021	---	---	---	---
Mar. 31, 1945	---	---	---	---	---	---	1.001	.012	.080	1.947	1.151	.352	.061	.000	5.228	.110	.011	.036	---	---	---	---

110. Little Conemaugh River at East Conemaugh

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Total acidity as H_2SO_4
									Parts per million													
Aug. 2, 1944	18	70		2.7	[illegible]	6.0	29	16	10	190	46	50		0	950	14	0.3	0.8	---	902	902	349
Apr. 3, 1945	660	57	3	3.35	46.4	8.9	4.5	.31	1.2	28	9.4	3.1	2.0	0	150	2.2	.1	1.5	214	161	161	64
									Equivalents per million													
Aug. 2, 1944	---	---	---	---	---	---	3.236	.806	.364	7.736	3.947	2.161		.000	19.779	.395	.016	.013	---	---	---	---
Apr. 3, 1945	---	---	---	---	---	---	.501	.017	.044	1.398	.773	.135	.051	.000	3.123	.062	.005	.029	---	---	---	---

110. Blacklick Creek at Blacklick

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Total acidity as H_2SO_4
									Parts per million													
Aug. 2, 1944	65	77	17	2.6	225	7.2	39	36	3.2	92	36	84		0	934	22	0.3	0.2	---	821	821	560
Apr. 4, 1945	1,080	60	4	3.20	46.2	8.3	4.4	.47	.5	18	7.2	5.8	1.2	0	133	2.4	.1	1.2	185	130	130	70
									Equivalents per million													
Aug. 2, 1944	---	---	---	---	---	---	4.336	1.934	.116	4.592	2.960	3.664		.000	19.445	.620	.016	.003	---	---	---	---
Apr. 4, 1945	---	---	---	---	---	---	.489	.025	.018	.898	.592	.252	.031	.000	2.769	.068	.005	.019	---	---	---	---

111. Loyalhanna Creek at Kingston

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Total acidity as H_2SO_4
									Parts per million													
Aug. 1, 1944	17	75	5	6.3	26.1	5.4	---	0.02	---	28	9.0	5.1		6	102	3.9	0.1	1.4	169	107	102	---
Apr. 2, 1945	239	56	5	5.1	16.2	5.2	---	.02	0.4	16	5.9	2.1		2	61	1.8	.0	1.3	103	64	53	---
									Equivalents per million													
Aug. 1, 1944	---	---	---	---	---	---	---	---	---	1.398	.740	.222		.098	2.124	.110	.005	.023	---	---	---	---
Apr. 2, 1945	---	---	---	---	---	---	---	---	---	.799	.485	.091		.033	1.270	.051	.000	.021	---	---	---	---

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

OHIO RIVER BASIN--Continued

112. Buffalo Creek near Freeport

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Sept. 6, 1944	8.05	70	7	7.4	48.0	3.4	---	0.01	---	45	9.3	35		76	86	52	0.2	0.4	280	151	88	---
Mar. 31, 1945	200	55	5	6.6	17.0	6.9	---	.08	0.0	16	4.3	8.3		20	42	10	.1	1.7	101	58	41	---
								Equivalents per million														
Sept. 6, 1944	---	---	---	---	---	---	---	---	---	2.246	.765	1.509		1.246	1.790	1.467	.011	.006	---	---	---	---
Mar. 31, 1945	---	---	---	---	---	---	---	---	---	.799	.354	.363		.328	.874	.282	.005	.027	---	---	---	---

113. Monongahela River at Greensboro

								Parts per million														
Aug. 15, 1944	2,100	82	7	3.3	65.0	3.9	5.8	0.13	1.2	35	15	18		0	214	10	0.2	1.3	336	199	199	73
Apr. 17, 1945	9,230	60	2	3.35	39.7	6.0	4.0	.11	.5	18	6.2	7.7	1.0	0	123	1.6	.2	1.0	176	118	118	54
								Equivalents per million														
Aug. 15, 1944	---	---	---	---	---	---	.645	.007	.044	1.747	1.069	.787		.000	4.455	.282	.011	.021	---	---	---	---
Apr. 17, 1945	---	---	---	---	---	---	.445	.006	.018	.898	.510	.335	.026	.000	2.561	.045	.011	.016	---	---	---	---

114. Monongahela River at Charleroi

								Parts per million														
Oct. 11-20, 1944	2,430	60	5	4.0	36.1	6.0	1.1	0.15	0.7	26	7.9	17	2.9	0	141	5.6	0.1	0.8	211	110	110	24
Mar. 21-31, 1945	19,000	51	2	3.90	28.5	5.6	2.3	.04	.4	20	6.4	11	.8	0	102	6.0	.3	1.2	161	96	96	24
								Equivalents per million														
Oct. 11-20, 1944	---	---	---	---	---	---	.122	.008	.026	1.298	.650	.739	.074	.000	2.936	.158	.005	.013	---	---	---	---
Mar. 21-31, 1945	---	---	---	---	---	---	.256	.002	.015	.998	.526	.478	.020	.000	2.124	.169	.016	.019	---	---	---	---

115. Monongahela River at Braddock

								Parts per million														
Sept. 9, 1944	1,430	80	8	3.7	69.4	12	5.0	0.04	2.6	82	22	73	3.8	0	451	25	0.4	0.8	704	336	336	56
Apr. 2, 1945	8,780	60	2	3.70	44.7	6.8	4.1	.08	.9	32	11	17	.6	0	185	4.5	.8	1.4	263	160	160	41
								Equivalents per million														
Sept. 9, 1944	---	---	---	---	---	---	.556	.002	.095	4.093	1.809	3.174	.097	.000	9.390	.705	.021	.013	---	---	---	---
Apr. 2, 1945	---	---	---	---	---	---	.456	.004	.033	1.597	.905	.739	.015	.000	3.850	.127	.042	.027	---	---	---	---

116. Dunkard Creek at Shannopin

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 15, 1944	7.3	83	4	3.4	130	11	5.3	0.24	4.2	103	40	83		0	570	45	0.7	0.1	901	478	478	65
Apr. 17, 1945	1,280	63	18	6.6	20.0	4.3	---	.06	0.0	19	4.7	9.8	1.5	32	49	11	.1	.8	117	67	41	---
								Equivalents per million														
Aug. 15, 1944	---	---	---	---	---	---	.590	.013	.153	5.141	3.290	3.622		.000	11.867	1.269	.037	.002	---	---	---	---
Apr. 17, 1945	---	---	---	---	---	---	---	---	---	.048	.387	.426	.038	.524	1.020	.310	.005	.013	---	---	---	---

117. South Fork Tenmile Creek at Jefferson

								Parts per million														
Aug. 15, 1944	1.22	75	10	7.3	49.5	3.4	---	0.02	---	45	8.6	46		130	72	43	0.1	1.6	294	144	37	---
Apr. 16, 1945	128	63	8	7.6	23.1	2.8	---	.02	0.0	29	4.8	10		84	32	8.2	.1	.8	134	92	23	---
								Equivalents per million														
Aug. 15, 1944	---	---	---	---	---	---	---	---	---	2.146	.724	2.004		2.131	1.499	1.213	.005	.026	---	---	---	---
Apr. 16, 1945	---	---	---	---	---	---	---	---	---	1.449	.395	.449		1.377	.666	.231	.005	.013	---	---	---	---

118. Dunlap Creek at Allison

								Parts per million														
Aug. 17, 1944	13	69	5	7.0	364	2.5	---	0.07	---	253	97	526		248	1,680	192	0.6	9.8	2,930	1,030	829	---
Apr. 16, 1945	38.3	63	5	6.9	286	6.0	---	.04	0.0	224	86	336	7.2	170	1,350	75	.8	5.5	2,340	913	773	---
								Equivalents per million														
Aug. 17, 1944	---	---	---	---	---	---	---	---	---	12.620	7.977	22.861		4.032	34.977	4.267	.032	.156	---	---	---	---
Apr. 16, 1945	---	---	---	---	---	---	---	---	---	11.180	7.072	14.611	.184	2.786	28.106	2.115	.042	.089	---	---	---	---

119. Redstone Creek at Waltersburg

								Parts per million														
Aug. 17, 1944	29	72	32	2.4	365	27	15	127	10	244	97	137		0	1,830	20	---	0.2	2,500	1,540	1,040	824
Apr. 16, 1945	83	5	40	2.8	332	26	67	174	2.0	190	89	69	1.8	0	1,850	11	1.1	.2	2,540	1,700	1,700	1,010
								Equivalents per million														
Aug. 17, 1944	---	---	---	---	---	---	1.449	6.322	.364	12.179	7.977	5.940		.000	38.100	.564	---	.013	---	---	---	---
Apr. 16, 1945	---	---	---	---	---	---	7.449	7.811	.033	9.481	7.311	2.998	.046	.000	38.518	.310	.018	.013	---	---	---	---

Iron in solution was approximately ... parts per million, ferric and ... parts per million, ferrous.

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

OHIO RIVER BASIN--Continued

120. Youghiogheny River at Connellsville

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 17, 1944	316	81	4	5.5	12.7	2.[illegible]	---	0.02	---	13	3.4	3.2		4	43	2.5	0.1	1.8	77	46	43	---
Apr. 20, 1945	2,680	52	8	5.4	7.72	3.8	---	.02	0.1	8.1	2.3	1.4		3	26	1.5	.1	1.0	49	30	27	---
								Equivalents per million														
Aug. 17, 1944	---	---	---	---	---	---	---	---	---	.649	.280	.137		.066	.895	.071	.005	.029	---	---	---	---
Apr. 20, 1945	---	---	---	---	---	---	---	---	---	.404	.189	.060		.049	.541	.042	.005	.016	---	---	---	---

121. Youghiogheny River at Sutersville

								Parts per million														
Aug. 18, 1944	334	77	7	3.2	77.7	7.0	5.0	0.16	1.2	54	18	8.2	27		0	293	16	0.3	0.3	462	269	269	52
Apr. 21, 1945	3,110	53	3	3.50	30.8	6.0	2.6	.03	.4	22	8.2	13	1.0	0	138	2.6	.1	1.6	199	120	120	36
								Equivalents per million														
Aug. 18, 1944	---	---	---	---	---	---	.536	.009	.043	2.695	1.480	1.189		.000	6.100	.451	.016	.005	---	---	---	---
Apr. 21, 1945	---	---	---	---	---	---	.289	.003	.019	1.098	.574	.565	.020	.000	2.873	.073	.005	.026	---	---	---	---

122. Casselman River at Markleton

								Parts per million														
Aug. 16, 1944	54	77	3	3.4	82.7	8.6	9.7	0.15	4.2	74	26	11		0	372	4.9	0.2	1.0	557	372	372	99
Apr. 13, 1945	980	53	3	4.35	12.3	4.6	.6	.04	.2	9.8	3.1	1.3	0.8	0	42	1.0	.1	1.5	68	42	42	18
								Equivalents per million														
Aug. 16, 1944	---	---	---	---	---	---	1.079	.008	.153	3.694	2.138	.478		.000	7.745	.138	.011	.016	---	---	---	---
Apr. 13, 1945	---	---	---	---	---	---	.037	.002	.007	.489	.255	.056	.020	.000	.874	.028	.005	.024	---	---	---	---

123. Laurel Hill Creek at Ursina

								Parts per million														
Aug. 16, 1944	27.5	62	8	7.1	6.86	0.9	---	0.01	---	8.1	2.2	1.2		22	11	1.2	0.1	0.4	39	29	11	---
Apr. 18, 1945	361	53	13	6.6	3.91	4.0	---	.10	0.0	4.8	1.4	.4		8	9.2	1.0	.1	1.1	28	18	11	---
								Equivalents per million														
Aug. 16, 1944	---	---	---	---	---	---	---	---	---	.404	.181	.050		.361	.229	.034	.005	.006	---	---	---	---
Apr. 18, 1945	---	---	---	---	---	---	---	---	---	.240	.115	.019		.131	.192	.028	.005	.018	---	---	---	---

124. Turtle Creek at Trafford

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Sept. 9, 1944	3.34	68	23	3.4	115	27	19	11	3.6	99	25	47		0	526	38	---	1.9	840	510	510	189
Apr. 2, 1945	83.0	62	5	2.80	132	20	21	7.5	2.2	76	26	13	1.6	0	528	7.5	0.2	1.7	723	529	529	260
								Equivalents per million														
Sept. 9, 1944	---	---	---	---	---	---	2.113	.394	.131	4.941	2.056	2.053		.000	10.951	1.072	---	.031	---	---	---	---
Apr. 2, 1945	---	---	---	---	---	---	2.336	.403	.080	3.793	2.138	.565	.041	.000	10.993	.212	.011	.027	---	---	---	---

125. Chartiers Creek at Carnegie

								Parts per million														
Sept. 8, 1944	57	64	55	2.6	279	20	31	112	7.2	156	73	167		0	1,470	94	---	0.4	2,480	1,300	1,300	---
Mar. 27, 1945	597	59	2	3.90	111	15	16	.08	1.7	97	37	56	1.9	0	571	20	0.2	2.5	866	493	493	120
								Equivalents per million														
Sept. 8, 1944	---	---	---	---	---	---	3.448	6.016	.262	7.786	6.003	7.267		.000	30.605	2.651	---	.006	---	---	---	---
Mar. 27, 1945	---	---	---	---	---	---	1.780	.004	.062	4.842	3.043	2.435	.049	.000	11.888	.564	.011	.040	---	---	---	---

126. Beaver River at Wampum

								Parts per million														
Aug. 30, 1944	640	66	10	6.6	43.7	4.0	---	0.01	---	52	12	16		47	131	20	0.6	12	291	179	141	---
Mar. 29, 1945	3,350	65	10	6.6	32.0	5.6	---	.09	0.0	37	8.7	10		41	91	11	.3	6.7	207	128	94	---
								Equivalents per million														
Aug. 30, 1944	---	---	---	---	---	---	---	---	---	2.595	.987	.705		.770	2.727	.564	.032	.194	---	---	---	---
Mar. 29, 1945	---	---	---	---	---	---	---	---	---	1.847	.715	.439		.672	1.895	.310	.016	.108	---	---	---	---

127. Shenango River at Sharpsville

								Parts per million														
Aug. 7, 1944	290	76	9	6.7	17.8	2.2	---	0.02	---	23	5.1	4.5		50	38	3.8	0.1	2.4	114	78	37	---
June 1, 1945	198	62	18	7.2	18.5	1.3	---	.01	0.0	24	5.2	4.4		66	29	3.5	.1	1.7	110	81	27	---
								Equivalents per million														
Aug. 7, 1944	---	---	---	---	---	---	---	---	---	1.148	.419	.195		.820	.791	.107	.005	.039	---	---	---	---
June 1, 1945	---	---	---	---	---	---	---	---	---	1.198	.428	.191		1.082	.604	.099	.005	.027	---	---	---	---

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Chemical analyses of surface waters of Pennsylvania, July-October 1944 and March-May 1945--Continued

OHIO RIVER BASIN--Continued

128. Little Shenango River at Greenville

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($Kx10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Aug. 7, 1944	21.2	77	10	7.5	23.8	5.4	---	0.01	---	34	7.0	1.9		106	26	3.2	0.1	1.9	142	116	29	---
Apr. 19, 1945	76	48	20	7.5	17.3	5.8	---	.08	0.0	24	5.2	2.2		69	25	2.0	.1	.6	107	81	25	---
								Equivalents per million														
Aug. 7, 1944	---	---	---	---	---	---	---	---	---	1.697	.625	.083		1.738	.541	.090	.005	.031	---	---	---	---
Apr. 19, 1945	---	---	---	---	---	---	---	---	---	1.198	.428	.097		1.131	.521	.056	.005	.010	---	---	---	---

129. Connoquenessing Creek at Hazen

								Parts per million														
Aug. 31, 1944	3.78	67	8	6.8	161	1.0	---	0.02	---	118	44	147		69	269	315	3.4	6.3	975	475	419	---
Mar. 29, 1945	503	59	7	6.5	28.0	8.2	---	.12	0.0	22	7.5	18		20	63	27	.2	4.4	168	86	69	---
								Equivalents per million														
Aug. 31, 1944	---	---	---	---	---	---	---	---	---	5.890	3.618	6.388		1.131	5.600	8.884	.179	.102	---	---	---	---
Mar. 29, 1945	---	---	---	---	---	---	---	---	---	1.098	.617	.769		.328	1.312	.762	.011	.071	---	---	---	---

130. Slippery Rock Creek at Wurtenburg

								Parts per million														
Aug. 31, 1944	45	66	9	7.7	44.2	2.8	---	0.02	---	54	11	11		92	95	21	0.1	0.4	274	180	105	---
Mar. 29, 1945	604	58	5	6.9	20.0	6.1	---	.06	0.0	23	5.4	5.8		26	57	7.0	.1	1.9	124	80	58	---
								Equivalents per million														
Aug. 31, 1944	---	---	---	---	---	---	---	---	---	2.695	.905	.489		1.508	1.978	.592	.005	.006	---	---	---	---
Mar. 29, 1945	---	---	---	---	---	---	---	---	---	1.148	.444	.254		.426	1.187	.197	.005	.031	---	---	---	---

131. Raccoon Creek at Moffatts Mill

								Parts per million														
Oct. 12, 1944	29	55	---	4.0	117	---	---	0.18	---	121	49	69		0	576	40	---	0.5	---	507	507	86
Mar. 29, 1945	286	56	4	3.45	86.8	14	13	.20	3.6	74	33	14	2.1	0	407	10	0.2	2.8	601	419	419	132
								Equivalents per million														
Oct. 12, 1944	---	---	---	---	---	---	---	.010	---	6.039	4.030	2.981		.000	11.992	1.128	---	.008	---	---	---	---
Mar. 29, 1945	---	---	---	---	---	---	1.446	.011	.131	3.694	2.714	.609	.054	.000	8.474	.282	.011	.045	---	---	---	---

132. Evitts Creek at Bedford Valley

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
								Parts per million														
Mar. 14, 1946	40	50	9	7.2	10.7	3.7	---	0.04	0.05	16	2.8	2.0		50	11	1.5	0.1	1.3	63	51	10	---
Aug. 14	4.9	66	5	7.6	21.5	3.3	---	.03	.00	35	5.4	3.2		122	12	1.8	.1	1.5	122	110	10	---
								Equivalents per million														
Mar. 14	40	---	---	---	---	---	---	---	---	0.798	0.230	0.088		0.819	0.229	0.042	0.005	0.021	---	---	---	---
Aug. 14	4.9	---	---	---	---	---	---	---	---	1.747	.444	.138		1.999	.250	.051	.005	.024	---	---	---	---

133. Licking Creek near Sylvan

								Parts per million														
Mar. 14	234	47	7	7.3	9.80	6.0	---	0.05	0.00	11	6.1	1.7		46	8.4	1.8	0.1	2.6	57	48	10	---
Aug. 16	20.8	70	7	7.7	25.1	2.2	---	.02	.00	31	12	2.5		138	12	2.2	.1	3.9	138	127	14	---
								Equivalents per million														
Mar. 14	234	---	---	---	---	---	---	---	---	0.599	0.354	0.074		0.754	0.175	0.051	0.005	0.042	---	---	---	---
Aug. 16	20.8	---	---	---	---	---	---	---	---	1.547	.987	.108		2.262	.250	.062	.005	.063	---	---	---	---

134. Conococheague Creek near State Line

								Parts per million														
Mar. 14	817	49	12	7.7	21.6	6.0	---	0.09	0.05	32	6.8	2.4		107	15	2.5	0.1	7.4	125	108	20	---
Aug. 14	180	72	5	8.0	32.1	5.0	---	.08	.00	47	9.7	4.4		[a]165	17	4.0	.1	9.6	182	157	22	---
								Equivalents per million														
Mar. 14	817	---	---	---	---	---	---	---	---	1.597	0.559	0.104		1.754	0.312	0.070	0.005	0.119	---	---	---	---
Aug. 14	180	---	---	---	---	---	---	---	---	2.345	.798	.191		2.704	.354	.113	.005	.155	---	---	---	---

135. Monocacy Creek at Pennsylvania State Line

								Parts per million														
Mar. 14	116	46	14	7.1	14.1	11	---	0.05	0.00	15	4.7	5.2		42	24	3.8	0.1	3.7	89	57	22	---
Aug. 14	12.2	71	15	6.8	14.6	8.2	---	.01	.00	16	4.5	5.9		49	23	2.9	.2	3.0	93	58	18	---
								Equivalents per million														
Mar. 14	116	---	---	---	---	---	---	---	---	0.749	0.386	0.225		0.688	0.500	0.107	0.005	0.060	---	---	---	---
Aug. 14	12.2	---	---	---	---	---	---	---	---	.798	.370	.255		.803	.479	.082	.011	.048	---	---	---	---

[a]Includes equivalent of 5 parts per million of carbonate (CO_3).

88.42
81.0
MERCE
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Chemical analyses of surface waters of Pennsylvania, collected during periods of low flow and of high flow, 1944-46--Continued

POTOMAC RIVER BASIN--Continued

136. Marsh Creek at Pennsylvania State Line

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$		Total acidity as H_2SO_4
																				Total	Non-carbonate	
								Parts per million														
Mar. 14		46	---	7.1	11.6	---	---	---	---	---	---	---		38	---	---	---	2.4	---	---	---	---
Aug. 14		---	15	6.0	14.1	---	---	---	---	---	---	---		51	25	2.0	---	.4	---	63	21	---
								Equivalents per million														
Mar. 14		---	---	---	---	---	---	---	---	---	---	---		0.623	---	---	---	0.039	---	---	---	---
Aug. 14		---	---	---	---	---	---	---	---	---	---	---		.836	0.521	0.056	---	.006	---	---	---	---

137. Rock Creek at Pennsylvania State Line

								Parts per million														
Mar. 14		46	---	6.8	17.8	---	---	---	---	---	---	---		48	---	---	---	6.9	---	---	---	---
Aug. 14		70	25	6.1	19.9	---	---	---	---	---	---	---		59	37	4	---	2.4	---	82	34	---
								Equivalents per million														
Mar. 14		---	---	---	---	---	---	---	---	---	---	---		0.787	---	---	---	0.195	---	---	---	---
Aug. 14		---	---	---	---	---	---	---	---	---	---	---		.967	0.770	0.113	---	.039	---	---	---	---

P38.42
2.10

Chemical analyses of surface waters of Pennsylvania, collected during periods of low flow and of high flow, 1944-46--Continued

ST. LAWRENCE RIVER BASIN

138. Conneaut Creek at Cherry Hill

Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Total acidity as H_2SO_4
								Parts per million														
Feb. 27	640	32	13	6.7	14.2	3.9	---	0.08	---	16	3.8	4.0		32	28	4.6	0.1	2.7	90	56	29	---
Aug. 4	21.3	70	10	7.3	29.8	1.3	---	.02	0.00	36	8.4	11		110	39	12	.2	.5	170	124	34	---
								Equivalents per million														
Feb. 27	640	---	---	---	---	---	---	---	---	0.798	0.312	0.176		0.524	0.583	0.130	0.005	0.044	---	---	---	---
Aug. 4	21.3	---	---	---	---	---	---	---	---	1.796	.691	.485		1.803	.812	.338	.011	.008	---	---	---	---

139. Mill Creek at Erie

								Parts per million														
Feb. 27	32.9	32	14	6.8	18.0	4.2	---	0.02	0.00	23	5.0	4.6		48	37	3.9	0.1	5.3	109	78	39	---
Aug. 4	1.00	76	10	7.8	33.0	3.6	---	.03	.00	45	10	6.6		124	49	8.2	.1	4.2	194	153	52	---
								Equivalents per million														
Feb. 27	32.9	---	---	---	---	---	---	---	---	1.148	0.411	0.200		0.787	0.770	0.111	0.005	0.086	---	---	---	---
Aug. 4	1.00	---	---	---	---	---	---	---	---	2.246	.822	.288		2.032	1.020	.231	.005	.068	---	---	---	---

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Delaware River near Richmond, Pa.
(Records of discharge published as Delaware River at Belvidere, N. J.)

Chemical analyses, in parts per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																			Total	Non-carbonate
Oct. 1-10, 1944---	1,601	62	8	7.0	7.86	1.2	0.02	---	9.8	2.1	2.3	1.3	26	13	2.2	0.0	0.2	48	33	12
Oct. 11-20--------	1,894	59	8	7.1	7.52	1.8	.01	0.0	8.6	2.0	2.9	1.3	26	12	2.0	.1	.2	44	30	8
Oct. 21-31--------	2,374	49	12	6.9	7.80	1.7	.01	---	8.9	2.2	2.5	2.1	25	12	2.6	.1	.4	45	31	11
Nov. 1-10---------	1,839	48	8	7.1	7.83	1.2	.01	---	10	2.5	1.9	1.5	26	13	2.5	.2	.4	44	35	14
Nov. 11-20--------	2,621	44	8	7.0	7.71	1.3	.01	---	9.2	2.2	2.8	1.4	27	13	2.5	.1	.2	44	32	10
Nov. 21-30--------	5,484	37	10	7.0	8.11	2.4	.02	---	9.3	2.7	2.5	1.4	26	15	2.5	.1	.6	49	34	13
Dec. 1-10---------	9,004	33	13	7.0	6.67	3.3	.02	---	7.5	2.2	2.4	1.1	18	15	2.0	.1	.6	43	28	13
Dec. 11-20--------	8,262	33	10	6.9	6.50	3.6	.01	---	7.4	2.1	2.1	1.1	20	13	2.0	.1	1.5	43	27	11
Dec. 21-31--------	4,669	32	8	7.0	7.34	3.0	.02	---	8.8	2.3	1.9	1.0	22	14	2.2	.1	1.4	46	31	13
Jan. 1-10, 1945---	13,340	32	12	6.8	6.25	3.4	.01	---	6.8	1.9	2.5	.9	15	13	1.8	.1	1.8	43	25	12
Jan. 11-20--------	5,440	32	7	6.9	6.97	3.6	.02	.0	8.4	2.3	2.0	.6	20	14	1.9	.1	1.3	44	30	14
Jan. 21-31--------	4,172	32	5	6.9	7.04	3.3	.01	.0	8.6	2.1	2.1	1.0	20	14	2.1	.1	1.2	44	30	14
Feb. 1-10---------	3,806	32	20	7.0	7.30	2.6	.01	---	8.6	2.2	2.1	1.1	20	13	2.1	.1	1.4	45	30	14
Feb. 11-20--------	4,124	32	10	7.0	7.13	2.8	.02	---	8.2	2.1	1.9	.8	20	13	1.2	.1	1.4	45	29	13
Feb. 21-28--------	10,730	32	10	6.9	6.75	3.0	.01	---	8.1	1.9	1.9	.9	18	14	2.0	.1	1.5	44	28	13
Mar. 1-10---------	32,840	32	8	6.5	5.98	3.1	.01	.0	6.0	1.9	1.7	.7	13	11	1.5	.2	2.2	40	23	12
Mar. 11-20--------	33,700	39	10	6.6	5.57	2.9	.01	.0	6.5	1.7	.8	.6	12	11	1.6	.2	1.1	35	23	13
Mar. 21-31--------	26,250	44	10	6.7	5.11	3.5	.02	.0	5.6	1.4	1.8	.8	14	10	1.1	.1	1.3	33	20	8
Apr. 1-10---------	17,540	52	24	6.7	5.62	3.1	.01	.0	6.2	1.6	1.7	.9	14	10	1.8	.2	1.4	38	22	11
Apr. 11-20--------	9,085	58	13	6.8	6.15	2.5	.01	---	7.0	2.0	2.1	.8	20	11	1.5	.1	.6	39	26	9
Apr. 21-30--------	9,494	51	13	7.0	6.20	2.1	.01	.0	7.2	1.9	1.8	.8	18	12	1.2	.1	.5	38	26	11
May 1-10----------	12,370	50	14	6.8	5.72	2.1	.04	.0	6.4	1.7	2.0	.9	16	11	1.5	.1	.6	36	23	10
May 11-20---------	19,420	56	35	6.7	5.36	2.3	.40	.0	6.1	1.5	2.0	.8	15	11	1.4	.1	.6	36	21	9
May 21-31---------	12,280	62	10	6.8	5.90	1.9	.01	.0	6.6	1.8	2.0	.7	19	10	1.2	.1	.6	38	24	8
June 1-10---------	11,150	56	20	6.9	6.21	2.9	.02	.0	6.9	1.9	1.9	.9	20	11	1.5	.1	.6	40	25	9
June 11-20--------	9,321	69	15	6.7	6.35	2.8	.01	.0	7.2	1.9	2.2		20	10	1.2	.1	1.0	39	26	9
June 21-30--------	10,820	74	28	6.8	6.40	3.1	.01	.0	7.5	1.9	2.4		20	9.8	1.1	.2	1.0	42	26	10
July 1-10---------	6,031	73	32	6.8	7.22	2.5	.07	.0	8.2	2.1	2.0	1.1	25	10	1.5	.2	1.2	48	29	9
July 11-20--------	16,010	70	8	6.7	6.98	3.5	.00	.0	7.7	2.1	1.6	.8	22	10	3.0	.2	1.0	46	28	10
July 21-31--------	26,570	69	7	6.6	6.05	3.8	.01	.0	7.1	1.7	1.5	.6	20	9.4	1.2	.2	1.3	42	25	8
Aug. 1-10---------	14,880	63	7	6.8	6.48	4.0	.02	.0	7.6	1.9	1.8	.6	22	9.3	1.5	.2	.8	44	27	9
Aug. 11-20--------	6,899	72	8	7.0	7.50	3.5	.01	.0	8.7	2.1	2.2	.6	26	9.6	2.5	.2	.8	47	30	9
Aug. 21-31--------	6,963	68	20	6.8	7.96	2.9	.02	.0	9.1	2.4	2.1	1.1	28	11	1.8	.2	1.7	48	33	10
Sept. 1-10--------	5,244	71	20	6.5	7.90	3.1	.01	.0	8.8	2.3	2.8	1.2	30	11	1.5	.1	1.2	51	31	7
Sept. 11-20-------	9,269	66	23	6.4	7.50	3.3	.03	.0	8.6	2.1	2.8	.9	26	9.8	1.8	.1	1.7	50	30	9
Sept. 21-30-------	10,090	62		6.7	6.99	3.9	.01	.0	8.4	2.1	1.7	1.2	24	11	.8	.1	1.4	44	30	10
Average-------	10,710	51	14	6.8	6.78	2.8	0.03	0.0	7.8	2.0	2.1	1.0	21	12	1.8	0.1	1.0	43	28	10

Chemical analyses, in equivalents per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate
Oct. 1-10, 1944---	1,601	---	---	---	---	---	---	---	0.489	0.173	0.100	0.033	0.426	0.271	0.062	0.000	0.003	---	---	---
Oct. 11-20--------	1,894	---	---	---	---	---	---	---	.429	.164	.126	.033	.426	.250	.056	.005	.003	---	---	---
Oct. 21-31--------	2,374	---	---	---	---	---	---	---	.444	.181	.109	.054	.410	.250	.073	.005	.006	---	---	---
Nov. 1-10---------	1,839	---	---	---	---	---	---	---	.499	.206	.083	.038	.426	.271	.071	.011	.006	---	---	---
Nov. 11-20--------	2,621	---	---	---	---	---	---	---	.459	.181	.122	.036	.443	.271	.071	.005	.003	---	---	---
Nov. 21-30--------	5,484	---	---	---	---	---	---	---	.464	.222	.109	.036	.426	.312	.071	.005	.010	---	---	---
Dec. 1-10---------	9,004	---	---	---	---	---	---	---	.374	.181	.104	.028	.295	.312	.056	.005	.010	---	---	---
Dec. 11-20--------	8,262	---	---	---	---	---	---	---	.369	.173	.091	.028	.328	.271	.056	.005	.024	---	---	---
Dec. 21-31--------	4,669	---	---	---	---	---	---	---	.439	.189	.083	.026	.361	.291	.062	.005	.023	---	---	---
Jan. 1-10, 1945---	13,340	---	---	---	---	---	---	---	.339	.156	.109	.023	.246	.271	.051	.005	.029	---	---	---
Jan. 11-20--------	5,440	---	---	---	---	---	---	---	.419	.189	.087	.015	.328	.292	.054	.005	.021	---	---	---
Jan. 21-31--------	4,172	---	---	---	---	---	---	---	.429	.173	.091	.026	.328	.292	.059	.005	.019	---	---	---
Feb. 1-10---------	3,806	---	---	---	---	---	---	---	.429	.181	.091	.028	.328	.271	.059	.005	.023	---	---	---
Feb. 11-20--------	4,124	---	---	---	---	---	---	---	.409	.173	.083	.020	.328	.271	.034	.005	.023	---	---	---
Feb. 21-28--------	10,730	---	---	---	---	---	---	---	.404	.156	.083	.023	.295	.292	.056	.005	.024	---	---	---
Mar. 1-10---------	32,840	---	---	---	---	---	---	---	.300	.156	.074	.018	.213	.229	.042	.011	.035	---	---	---
Mar. 11-20--------	33,700	---	---	---	---	---	---	---	.324	.140	.035	.015	.197	.229	.045	.011	.016	---	---	---
Mar. 21-31--------	26,250	---	---	---	---	---	---	---	.280	.115	.078	.020	.230	.208	.031	.005	.021	---	---	---
Apr. 1-10---------	17,540	---	---	---	---	---	---	---	.309	.132	.074	.023	.230	.208	.051	.011	.023	---	---	---
Apr. 11-20--------	9,085	---	---	---	---	---	---	---	.349	.165	.091	.020	.328	.229	.042	.005	.010	---	---	---
Apr. 21-30--------	9,494	---	---	---	---	---	---	---	.359	.156	.078	.020	.295	.250	.034	.005	.008	---	---	---
May 1-10----------	12,370	---	---	---	---	---	---	---	.319	.140	.087	.023	.262	.229	.042	.005	.010	---	---	---
May 11-20---------	19,420	---	---	---	---	---	---	---	.304	.123	.087	.020	.246	.229	.040	.005	.010	---	---	---
May 21-31---------	12,280	---	---	---	---	---	---	---	.329	.148	.087	.018	.311	.208	.034	.005	.010	---	---	---
June 1-10---------	11,150	---	---	---	---	---	---	---	.344	.156	.078	.023	.328	.229	.042	.005	.010	---	---	---
June 11-20--------	9,321	---	---	---	---	---	---	---	.359	.156	0.096		.328	.208	.034	.005	.010	---	---	---
June 21-30--------	10,820	---	---	---	---	---	---	---	.374	.156	.104		.328	.204	.031	.011	.010	---	---	---
July 1-10---------	6,031	---	---	---	---	---	---	---	.409	.173	.087	.028	.410	.208	.042	.011	.010	---	---	---
July 11-20--------	16,010	---	---	---	---	---	---	---	.384	.173	.070	.020	.361	.208	.036	.011	.010	---	---	---
July 21-31--------	26,570	---	---	---	---	---	---	---	.354	.140	.065	.015	.328	.196	.034	.011	.021	---	---	---
Aug. 1-10---------	14,880	---	---	---	---	---	---	---	.379	.156	.078	.015	.361	.194	.042	.011	.013	---	---	---
Aug. 11-20--------	6,899	---	---	---	---	---	---	---	.434	.173	.096	.015	.426	.200	.070	.011	.013	---	---	---
Aug. 21-31--------	6,963	---	---	---	---	---	---	---	.454	.197	.091	.028	.459	.229	.051	.011	.027	---	---	---
Sept. 1-10--------	5,244	---	---	---	---	---	---	---	.439	.189	.091	.041	.492	.229	.042	.008	.018	---	---	---
Sept. 11-20-------	9,269	---	---	---	---	---	---	---	.429	.173	.122	.023	.426	.204	.051	.005	.027	---	---	---
Sept. 21-30-------	10,090	---	---	---	---	---	---	---	.419	.173	.074	.031	.393	.229	.023	.005	.023	---	---	---
Average---------	10,710	---	---	---	---	---	---	---	0.399	0.164	0.091	0.026	0.344	0.250	0.051	0.008	0.016	---	---	---

P 38.42
2.10

MERCE

ROCEDURE

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Delaware River near Richmond, Pa.
(Records of discharge published as Delaware River at Belvidere, N. J.)

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																	Total	Non-carbonate
Oct. 1-10, 1945	10,520	56	17	6.7	6.52	3.9	0.01	7.3	2.1	1.3	20	9.5	1.8	0.1	0.8	42	27	10
Oct. 11-20	11,850	48	15	7.0	6.56	4.1	.03	6.8	1.8	3.1	20	11	1.5	.1	1.1	41	24	8
Oct. 21-31	6,912	51	17	6.6	6.68	2.8	.02	7.7	2.1	2.3	24	9.9	1.8	.1	.2	41	28	8
Nov. 1-10	9,571	50	12	6.6	6.28	2.0	.01	7.1	1.7	3.4	22	10	2.0	.1	.8	38	25	7
Nov. 11-20	13,110	45	15	6.6	5.89	3.3	.01	7.0	1.7	3.0	20	11	1.8	.1	.4	40	24	8
Nov. 21-30	17,300	38	13	6.7	6.11	3.5	.01	6.6	1.7	2.9	18	11	1.8	.1	1.0	39	23	9
Dec. 1-10	11,800	34	13	6.6	6.96	3.2	.04	7.8	2.0	3.0	22	12	1.2	.2	1.6	44	28	10
Dec. 11-20	7,553	32	10	6.6	7.18	2.9	.01	7.7	2.1	2.5	20	11	2.1	.1	2.8	43	28	11
Dec. 21-31	8,937	32	7	6.7	6.82	2.6	.01	8.0	2.2	2.1	20	12	2.0	.1	2.1	43	29	13
Jan. 1-10, 1946	17,030	33	8	6.7	6.31	2.8	.01	7.2	1.8	1.4	17	10	1.4	.0	2.5	41	25	11
Jan. 11-20	13,530	35	9	6.8	6.87	3.2	.01	6.8	2.0	3.2	19	11	2.2	.1	2.2	43	25	10
Jan. 21-31	6,201	32	8	7.1	7.54	4.6	.02	8.0	2.8	1.7	23	11	2.2	.1	1.9	46	31	13
Feb. 1-10	5,352	33	6	6.9	7.69	3.7	.01	8.8	2.3	2.5	25	12	1.5	.1	1.9	47	31	11
Feb. 11-20	5,904	33	7	6.9	7.25	2.7	.01	8.0	2.2	3.9	25	12	2.1	.1	1.5	45	29	8
Feb. 21-28	4,710	33	4	7.2	7.47	3.2	.01	8.5	1.9	3.1	22	11	3.1	.1	2.1	42	29	11
Mar. 1-10	22,950	35	12	6.6	5.52	2.9	.02	5.7	1.4	3.7	14	9.5	1.8	.1	4.9	36	20	8
Mar. 11-20	19,790	38	7	7.1	5.56	3.0	.01	6.0	1.6	1.8	15	8.3	1.8	.1	2.1	36	22	9
Mar. 21-31	10,320	43	24	6.8	6.68	2.2	.01	7.4	1.9	2.9	20	11	1.8	.1	2.2	41	26	10
Apr. 1-10	6,990	37	25	6.8	6.90	1.4	.02	7.8	2.0	3.0	23	11	1.6	.1	1.8	41	28	9
Apr. 11-20	5,693	55	6	6.8	6.71	1.5	.02	7.8	2.0	3.1	25	10	2.1	.1	.4	40	28	7
Apr. 21-30	4,813	57	8	7.0	6.96	1.3	.01	7.8	2.0	2.8	22	11	2.0	.1	1.4	41	28	10
May 1-10	4,809	57	7	7.0	6.73	1.5	.02	7.4	1.9	2.5	20	11	2.0	.1	1.0	40	26	10
May 11-20	8,840	59	13	6.8	6.34	1.2	.01	7.0	1.9	3.2	22	10	1.8	.1	1.3	39	25	7
May 21-31	28,120	61	12	6.8	6.18	3.1	.03	5.6	1.5	4.2	18	10	2.0	.2	1.0	40	20	5
June 1-10	20,010	62	20	6.7	6.93	3.4	.07	8.2	1.8	2.8	26	9.7	1.4	.1	.5	44	28	7
June 11-20	8,092	65	7	6.9	6.65	1.6	.03	7.8	1.9	4.7	27	11	2.0	.1	1.1	41	27	5
June 21-30	4,652	67	10	7.1	7.70	1.5	.02	9.4	2.3	2.8	29	11	2.0	.1	1.0	50	33	9
July 1-10	5,146	75	10	7.1	7.22	2.1	.01	8.5	2.1	2.3	26	10	1.5	.1	.9	48	30	9
July 11-20	2,871	77	7	7.0	8.23	2.1	.02	9.2	2.4	2.6	28	11	2.0	.1	1.2	48	33	10
July 21-31	4,634	77	15	6.9	7.72	2.6	.02	8.6	2.2	2.3	25	11	1.9	—	1.0	48	30	10
Aug. 1-10	3,953	75	12	7.0	7.75	3.1	.02	9.0	2.2	2.9	28	11	2.0	—	.8	49	32	9
Aug. 11-20	3,209	72	10	7.0	7.68	2.6	.02	8.8	2.1	3.9	30	11	2.0	—	.4	48	31	6
Aug. 21-31	2,418	70	7	7.2	7.63	1.6	.02	8.8	2.2	3.5	29	11	2.2	—	.4	46	31	7
Sept. 1-10	1,848	71	9	7.1	7.79	1.0	.02	9.0	2.2	2.7	27	11	2.4	—	.5	47	32	9
Sept. 11-20	1,860	70	12	6.9	7.82	2.0	.01	9.4	2.0	2.9	27	11	2.4	.1	1.0	47	32	10
Sept. 21-30	4,593	69	18	6.9	7.41	2.8	.01	8.2	1.9	3.4	24	11	2.4	.1	1.0	48	28	9
Average	9,088	52	11	6.9	6.95	2.6	0.02	7.8	2.0	3.2	23	11	2.0	0.1	1.4	43	28	9

Delaware River near Richmond, Pa.
(Records of discharge published as Delaware River at Belvidere, N. J.)

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																	Total	Non-carbonate
Oct. 1-10, 1945	10,520	---	---	---	---	---	---	0.364	0.173	0.058	0.328	0.198	0.051	0.005	0.013	---	---	---
Oct. 11-20	11,850	---	---	---	---	---	---	.339	.148	.135	.328	.229	.042	.005	.018	---	---	---
Oct. 21-31	6,912	---	---	---	---	---	---	.384	.173	.101	.393	.206	.051	.005	.003	---	---	---
Nov. 1-10	9,571	---	---	---	---	---	---	.354	.140	.149	.361	.208	.056	.005	.013	---	---	---
Nov. 11-20	13,110	---	---	---	---	---	---	.349	.140	.130	.328	.229	.051	.005	.006	---	---	---
Nov. 21-30	17,300	---	---	---	---	---	---	.329	.140	.127	.295	.229	.051	.005	.016	---	---	---
Dec. 1-10	11,800	---	---	---	---	---	---	.389	.164	.129	.361	.250	.034	.011	.026	---	---	---
Dec. 11-20	7,553	---	---	---	---	---	---	.384	.173	.109	.328	.229	.059	.005	.045	---	---	---
Dec. 21-31	8,937	---	---	---	---	---	---	.399	.181	.093	.328	.250	.056	.005	.034	---	---	---
Jan. 1-10, 1946	17,030	---	---	---	---	---	---	.359	.148	.060	.279	.208	.040	.000	.040	---	---	---
Jan. 11-20	13,530	---	---	---	---	---	---	.339	.164	.140	.311	.229	.062	.005	.036	---	---	---
Jan. 21-31	6,201	---	---	---	---	---	---	.399	.230	.075	.377	.229	.062	.005	.031	---	---	---
Feb. 1-10	5,352	---	---	---	---	---	---	.439	.189	.110	.410	.250	.042	.005	.031	---	---	---
Feb. 11-20	5,904	---	---	---	---	---	---	.399	.181	.168	410	.250	.059	.005	.024	---	---	---
Feb. 21-28	4,710	---	---	---	---	---	---	.424	.156	.136	.361	.229	.087	.005	.034	---	---	---
Mar. 1-10	22,950	---	---	---	---	---	---	.284	.115	.163	.229	.198	.051	.005	.079	---	---	---
Mar. 11-20	19,790	---	---	---	---	---	---	.299	.132	.078	.246	.173	.051	.005	.034	---	---	---
Mar. 21-31	10,320	---	---	---	---	---	---	.369	.156	.124	.328	.229	.051	.005	.036	---	---	---
Apr. 1-10	6,990	---	---	---	---	---	---	.389	.164	.132	.377	.229	.045	.005	.029	---	---	---
Apr. 11-20	5,693	---	---	---	---	---	---	.389	.164	.136	.410	.208	.059	.005	.007	---	---	---
Apr. 21-30	4,813	---	---	---	---	---	---	.389	.164	.121	.361	.229	.056	.005	.023	---	---	---
May 1-10	4,809	---	---	---	---	---	---	.369	.156	.109	.328	.229	.056	.005	.016	---	---	---
May 11-20	8,840	---	---	---	---	---	---	.349	.156	.141	.361	.208	.051	.005	.021	---	---	---
May 21-31	28,120	---	---	---	---	---	---	.270	.123	.184	.295	.208	.056	.011	.016	---	---	---
June 1-10	20,010	---	---	---	---	---	---	.409	.148	.123	.426	.202	.039	.005	.008	---	---	---
June 11-20	8,092	---	---	---	---	---	---	.389	.156	.205	.442	.229	.056	.005	.018	---	---	---
June 21-30	4,652	---	---	---	---	---	---	.469	.189	.123	.475	.229	.056	.005	.016	---	---	---
July 1-10	5,146	---	---	---	---	---	---	.424	.173	.099	.426	.208	.042	.005	.015	---	---	---
July 11-20	2,871	---	---	---	---	---	---	.459	.197	.112	.459	.229	.056	.005	.019	---	---	---
July 21-31	4,634	---	---	---	---	---	---	.429	.181	.099	.410	.229	.054	---	.016	---	---	---
Aug. 1-10	3,953	---	---	---	---	---	---	.449	.181	.127	.459	.229	.056	---	.013	---	---	---
Aug. 11-20	3,209	---	---	---	---	---	---	.439	.173	.171	.492	.229	.056	---	.006	---	---	---
Aug. 21-31	2,418	---	---	---	---	---	---	.439	.181	.152	.475	.229	.062	---	.006	---	---	---
Sept. 1-10	1,848	---	---	---	---	---	---	.449	.181	.117	.442	.229	.068	---	.008	---	---	---
Sept. 11-20	1,860	---	---	---	---	---	---	.469	.164	.127	.442	.229	.068	.005	.016	---	---	---
Sept. 21-30	4,593	---	---	---	---	---	---	.409	.156	.140	.393	.229	.068	.005	.016	---	---	---
Average	9,088	---	---	---	---	---	---	0.389	0.164	0.137	0.377	0.229	0.056	0.005	0.023	---	---	---

P 88.49
8.10

Delaware River at Morrisville, Pa.

(Records of discharge published as Delaware River at Trenton, N. J.)

Chemical analyses, in parts per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate
Oct. 1-10, 1944---	2,495	62	9	7.2	14.7	2.3	0.02	---	21	6.6	5.5	2.2	82	32	6.5	0.1	3.2	116	80	37
Oct. 11-20--------	2,578	59	9	7.2	18.0	2.0	.01	0.0	19	6.5	5.4	1.8	83	30	6.1	.0	3.5	102	74	31
Oct. 21-31--------	3,373	52	10	7.1	17.0	2.3	.02	.1	19	6.2	5.5	1.9	46	31	6.0	.1	3.2	98	73	35
Nov. 1-10---------	2,606	52	8	7.0	17.3	1.6	.02	---	18	6.2	5.3	2.0	50	29	6.2	.1	3.1	96	70	29
Nov. 11-20--------	3,323	49	8	7.1	17.5	1.9	.02	---	18	6.4	5.9	2.1	50	30	7.0	.2	3.3	100	71	30
Nov. 21-30--------	8,223	43	23	7.0	14.4	5.1	.07	---	14	5.1	4.4	1.9	34	30	5.0	.2	4.0	87	56	28
Dec. 1-10---------	11,750	38	8	6.8	11.4	4.7	.02	---	12	4.0	3.6	1.0	27	23	3.8	.2	4.5	70	46	24
Dec. 11-20--------	12,180	36	10	6.9	10.6	4.4	.04	---	11	3.8	3.3	.7	24	23	3.5	.1	5.2	67	43	23
Dec. 21-31--------	6,631	36	8	6.8	14.0	5.3	.06	.0	15	5.0	4.3	1.8	31	30	5.8	.1	5.9	88	58	33
Jan. 1-10, 1945---	17,400	36	11	6.8	11.2	4.7	.05	---	11	3.1	4.1	1.2	21	23	3.5	.1	4.7	70	40	23
Jan. 11-20--------	7,390	36	10	7.0	13.8	4.6	.09	.0	16	5.0	4.1	1.0	34	28	5.8	.1	5.9	87	60	33
Jan. 21-31--------	5,827	35	8	7.1	14.5	4.8	.08	.0	16	4.9	4.1	1.1	37	27	5.5	.1	4.1	88	60	30
Feb. 1-10---------	5,280	36	15	7.1	14.4	3.6	.04	---	15	5.0	4.1	1.5	37	27	5.0	.0	3.9	87	58	28
Feb. 11-20--------	5,954	36	30	7.1	13.6	3.6	.03	---	13	4.7	3.7	1.4	35	25	4.5	.1	3.0	81	52	23
Feb. 21-28--------	18,650	40	10	6.6	11.9	5.2	.06	.0	13	4.0	3.3	1.2	26	23	3.8	.1	5.9	74	49	28
Mar. 1-10---------	42,230	40	12	6.7	8.27	2.3	.02	.0	10	2.8	2.3	.7	17	18	2.5	.2	4.0	53	36	22
Mar. 11-20--------	37,660	45	12	6.8	7.73	3.9	.02	.0	8.5	2.6	1.7	.8	18	15	2.2	.2	2.8	50	32	17
Mar. 21-31--------	31,940	51	10	6.7	7.21	4.2	.02	.0	7.6	2.3	2.3	.7	19	14	1.8	.1	1.6	44	28	13
Apr. 1-10---------	22,580	56	13	6.8	8.58	4.2	.04	.0	9.2	2.9	2.6	.7	24	16	2.2	.1	.8	52	34	15
Apr. 11-20--------	13,240	61	15	7.1	10.3	3.7	.03	.0	11	3.6	2.8	1.0	29	19	2.9	.2	2.5	61	42	18
Apr. 21-30--------	13,120	56	12	7.0	10.6	3.9	.02	.0	12	3.8	2.8	1.0	30	20	3.0	.1	2.0	64	46	21
May 1-10----------	16,990	54	11	6.9	9.18	3.3	.02	.0	9.6	3.0	2.9	1.1	24	18	2.5	.1	1.8	56	36	17
May 11-20---------	25,720	59	12	6.8	8.38	2.1	.02	.0	8.7	2.7	2.4	.9	21	17	2.2	.1	1.9	51	33	16
May 21-31---------	16,760	64	11	6.9	9.10	2.9	.01	.0	9.7	3.0	2.6	.8	26	16	2.4	.0	2.0	57	37	15
June 1-10---------	15,260	60	12	6.9	9.62	3.5	.02	.0	10	3.2	2.6	.8	27	17	2.6	.0	2.4	60	38	16
June 11-20--------	12,440	73	12	7.0	10.2	2.4	.01	.0	11	3.6	2.9		30	17	2.8	.1	2.1	61	42	18
June 21-30--------	15,130	74	18	6.9	10.0	3.7	.01	.0	11	3.3	2.8	1.1	28	17	2.8	.0	2.6	64	41	18
July 1-10---------	10,450	78	11	7.0	12.1	3.5	.03	.0	13	4.2	2.8	1.6	34	21	3.5	.1	3.2	76	50	22
July 11-20--------	26,200	72	25	6.9	13.0	5.9	.12	.0	15	3.8	3.0	1.4	35	24	2.8	.1	3.9	85	53	24
July 21-31--------	38,220	72	25	6.7	9.97	5.4	.05	.0	10	3.2	2.6	1.1	27	17	1.8	.2	3.0	64	38	16
Aug. 1-10---------	21,380	70	20	6.9	10.6	5.8	.03	.0	11	3.6	2.7	1.2	31	18	2.1	.2	2.7	67	42	17
Aug. 11-20--------	10,480	73	15	6.9	13.0	4.3	.02	.0	14	4.8	2.8	1.3	43	20	3.2	.1	1.6	76	55	19
Aug. 21-31--------	10,640	71	15	6.9	13.9	3.2	.02	.0	15	5.2	3.1	1.6	44	22	4.0	.2	2.1	82	59	23
Sept. 1-10--------	7,711	74	10	6.9	14.4	3.8	.10	.0	15	5.6	4.0	1.5	50	22	4.3	.1	2.0	91	60	20
Sept. 11-20-------	14,160	70	20	6.8	13.2	5.2	.04	.0	14	4.8	4.4	1.6	38	22	3.5	.1	3.6	82	55	24
Sept. 21-30-------	15,310	66	---	7.0	11.6	5.3	.04	.0	13	3.8	2.4	1.3	32	19	3.0	.2	3.1	71	48	22
Average--------	14,760	55	13	6.9	12.2	3.8	0.04	0.0	13	4.2	3.5	1.3	33	22	3.8	0.1	3.2	74	50	23

Delaware River at Morrisville, Pa.

(Records of discharge published as Delaware River at Trenton, N. J.)

Chemical analyses, in equivalents per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate
Oct. 1-10, 1944	2,495	---	---	---	---	---	---	---	1.048	0.543	0.239	0.056	0.852	0.666	0.183	0.005	0.052	---	---	---
Oct. 11-20	2,578	---	---	---	---	---	---	---	.948	.535	.235	.046	.869	.625	.172	.000	.056	---	---	---
Oct. 21-31	3,373	---	---	---	---	---	---	---	.945	.510	.239	.049	.754	.645	.169	.005	.052	---	---	---
Nov. 1-10	2,606	---	---	---	---	---	---	---	.898	.510	.230	.051	.820	.604	.175	.005	.050	---	---	---
Nov. 11-20	3,323	---	---	---	---	---	---	---	.898	.526	.256	.054	.820	.625	.197	.011	.053	---	---	---
Nov. 21-30	8,223	---	---	---	---	---	---	---	.699	.419	.191	.049	.557	.625	.141	.011	.064	---	---	---
Dec. 1-10	11,750	---	---	---	---	---	---	---	.599	.329	.157	.026	.443	.479	.107	.011	.073	---	---	---
Dec. 11-20	12,180	---	---	---	---	---	---	---	.549	.312	.144	.018	.393	.479	.099	.005	.084	---	---	---
Dec. 21-31	6,631	---	---	---	---	---	---	---	.749	.411	.187	.046	.508	.625	.164	.005	.095	---	---	---
Jan. 1-10, 1945	17,400	---	---	---	---	---	---	---	.549	.255	.178	.031	.344	.479	.099	.005	.076	---	---	---
Jan. 11-20	7,390	---	---	---	---	---	---	---	.799	.411	.178	.026	.557	.583	.164	.005	.095	---	---	---
Jan. 21-31	5,827	---	---	---	---	---	---	---	.799	.403	.178	.023	.606	.562	.155	.005	.066	---	---	---
Feb. 1-10	5,280	---	---	---	---	---	---	---	.749	.411	.178	.038	.606	.562	.141	.000	.063	---	---	---
Feb. 11-20	5,954	---	---	---	---	---	---	---	.649	.387	.161	.036	.574	.520	.127	.005	.048	---	---	---
Feb. 21-28	18,650	---	---	---	---	---	---	---	.649	.329	.144	.031	.426	.479	.107	.005	.095	---	---	---
Mar. 1-10	42,230	---	---	---	---	---	---	---	.499	.230	.100	.018	.279	.375	.071	.011	.064	---	---	---
Mar. 11-20	37,660	---	---	---	---	---	---	---	.424	.214	.074	.020	.295	.312	.062	.011	.045	---	---	---
Mar. 21-31	31,940	---	---	---	---	---	---	---	.379	.189	.100	.018	.311	.292	.051	.005	.026	---	---	---
Apr. 1-10	22,580	---	---	---	---	---	---	---	.459	.230	.113	.018	.393	.333	.062	.005	.013	---	---	---
Apr. 11-20	13,240	---	---	---	---	---	---	---	.540	.296	.121	.026	.475	.396	.082	.011	.040	---	---	---
Apr. 21-30	13,120	---	---	---	---	---	---	---	.599	.312	.122	.026	.492	.416	.085	.005	.032	---	---	---
May 1-10	16,990	---	---	---	---	---	---	---	.479	.247	.126	.028	.393	.375	.071	.005	.029	---	---	---
May 11-20	25,720	---	---	---	---	---	---	---	.431	.222	.104	.023	.344	.354	.062	.005	.031	---	---	---
May 21-31	16,760	---	---	---	---	---	---	---	.484	.247	.113	.020	.426	.333	.068	.000	.032	---	---	---
June 1-10	15,260	---	---	---	---	---	---	---	.499	.263	.113	.020	.442	.354	.073	.000	.039	---	---	---
June 11-20	12,440	---	---	---	---	---	---	---	.549	.296	0.126		.492	.354	.079	.005	.034	---	---	---
June 21-30	15,130	---	---	---	---	---	---	---	.549	.271	.122	.028	.459	.354	.079	.000	.042	---	---	---
July 1-10	10,450	---	---	---	---	---	---	---	.641	.345	.122	.041	.557	.437	.099	.005	.052	---	---	---
July 11-20	26,200	---	---	---	---	---	---	---	.749	.312	.130	.036	.574	.500	.079	.005	.063	---	---	---
July 21-31	38,220	---	---	---	---	---	---	---	.499	.263	.113	.028	.442	.354	.051	.011	.048	---	---	---
Aug. 1-10	21,380	---	---	---	---	---	---	---	.549	.296	.117	.031	.508	.375	.059	.011	.044	---	---	---
Aug. 11-20	10,480	---	---	---	---	---	---	---	.699	.395	.122	.033	.705	.416	.090	.005	.026	---	---	---
Aug. 21-31	10,640	---	---	---	---	---	---	---	.749	.428	.135	.041	.721	.458	.113	.011	.034	---	---	---
Sept. 1-10	7,711	---	---	---	---	---	---	---	.749	.460	.174	.038	.819	.458	.121	.005	.032	---	---	---
Sept. 11-20	14,160	---	---	---	---	---	---	---	.699	.395	.191	.041	.623	.458	.099	.005	.058	---	---	---
Sept. 21-30	15,310	---	---	---	---	---	---	---	.649	.312	.104	.033	.524	.396	.085	.011	.050	---	---	---
Average	14,760	---	---	---	---	---	---	---	0.649	0.345	0.152	0.033	0.541	0.498	0.107	0.005	0.052	---	---	---

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ROCEDURE

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Delaware River at Morrisville, Pa.

(Records of discharge published as Delaware River at Trenton, N. J.)

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Picarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																	Total	Noncarbonate
Oct. 1-10, 1945	13,030	61	12	7.1	11.5	5.1	0.02	13	4.5	0.9	34	18	3.0	0.1	2.1	69	51	23
Oct. 11-20	16,360	55	15	7.0	9.72	4.3	.03	10	3.1	4.6	29	17	3.0	.1	2.2	58	38	22
Oct. 21-31	9,207	56	10	6.8	12.2	3.8	.02	13	4.3	3.2	38	19	3.6	.1	.9	66	50	19
Nov. 1-10	11,260	53	11	6.9	11.2	3.4	.02	12	3.8	3.8	34	18	3.6	.1	2.2	64	46	18
Nov. 11-20	15,460	51	10	6.9	9.80	4.1	.01	10	3.1	3.3	28	16	3.0	.1	2.2	58	38	15
Nov. 21-30	25,770	43	9	6.9	9.59	4.3	.01	10	3.0	3.9	25	18	3.4	.1	1.9	57	37	17
Dec. 1-10	18,870	40	10	6.9	10.6	4.5	.05	11	3.9	3.5	28	20	3.4	.1	3.0	65	44	21
Dec. 11-20	11,900	37	7	7.0	12.4	3.6	.04	13	4.3	4.3	34	22	4.1	.1	3.3	72	50	22
Dec. 21-31	15,880	37	8	6.8	14.6	4.9	.02	14	5.0	4.7	30	27	6.0	.1	5.4	86	56	31
Jan. 1-10, 1946	23,740	41	14	7.1	11.5	5.2	.03	12	3.9	2.9	30	20	2.6	.0	4.1	71	46	21
Jan. 11-20	20,340	40	8	7.0	9.38	4.4	.01	10	3.5	3.5	26	18	3.4	.1	2.4	63	39	18
Jan. 21-31	9,552	37	10	7.1	13.8	5.2	.03	14	4.9	5.0	41	21	4.5	.1	4.8	80	55	22
Feb. 1-10	8,078	39	2	7.0	14.5	5.4	.02	15	5.2	5.8	43	24	5.0	.1	4.8	86	59	24
Feb. 11-20	8,252	39	2	7.1	14.0	5.0	.03	15	4.9	4.2	41	22	4.8	.1	4.1	81	58	24
Feb. 21-29	6,848	37	6	7.2	15.1	5.0	.03	15	5.1	5.7	40	25	5.4	.1	5.0	87	58	26
Mar. 1-10	26,300	43	13	6.9	10.8	4.4	.02	12	3.2	2.7	26	19	3.5	.1	3.4	64	43	22
Mar. 11-20	27,850	46	12	7.0	8.53	4.3	.03	9.5	2.9	2.0	20	16	2.5	.1	3.7	54	36	19
Mar. 21-31	16,620	51	17	7.1	11.0	5.2	.14	12	3.9	3.1	28	21	3.6	.1	3.2	67	46	23
Apr. 1-10	10,620	52	12	7.2	12.7	3.1	.07	13	4.4	3.9	34	22	4.0	.2	2.6	76	51	23
Apr. 11-20	8,149	53	25	7.1	13.4	1.9	.03	14	4.7	4.6	40	22	4.4	.1	2.7	79	54	21
Apr. 21-30	6,707	59	5	7.3	14.1	2.3	.02	15	5.0	4.0	42	23	4.8	.1	1.8	82	58	24
May 1-10	6,422	60	6	7.4	14.1	1.3	.03	15	5.0	3.7	42	22	4.9	.1	1.9	82	58	24
May 11-20	13,200	63	15	6.9	12.1	2.8	.05	13	4.3	3.3	34	21	3.8	.1	2.6	75	50	22
May 21-31	37,450	64	20	6.9	7.84	3.5	.05	8.2	2.6	2.9	21	15	2.1	.1	1.7	50	31	14
June 1-10	32,150	63	13	7.3	8.87	5.0	.08	9.4	2.9	4.3	27	17	2.2	.2	1.7	62	35	13
June 11-20	12,460	70	7	7.3	12.0	4.5	.03	13	4.1	4.9	39	20	3.8	.1	2.0	71	49	17
June 21-30	7,236	74	7	7.2	14.5	2.3	.04	16	5.2	3.9	44	23	5.5	.1	2.3	86	61	25
July 1-10	7,983	77	5	7.2	14.9	3.8	.02	17	5.2	3.7	46	24	4.5	.1	3.1	100	64	26
July 11-20	4,610	78	5	7.4	17.6	4.1	.02	19	6.3	4.9	54	27	6.0	.1	3.6	111	73	29
July 21-31	10,090	75	10	7.2	14.4	4.9	.05	15	5.0	4.3	40	24	4.4	.1	3.7	87	58	25
Aug. 1-10	5,823	75	8	7.3	17.0	3.9	.02	18	5.9	4.5	48	27	6.2	---	3.4	101	69	30
Aug. 11-20	5,984	74	10	7.2	16.2	3.9	.03	17	5.4	5.5	49	25	6.0	---	2.4	96	65	24
Aug. 21-31	4,449	72	12	7.2	17.7	3.4	.02	19	6.2	6.9	57	28	7.0	---	2.8	109	73	26
Sept. 1-10	3,301	71	8	7.3	19.8	3.7	.01	21	7.1	6.3	62	30	7.0	.1	3.9	113	82	31
Sept. 11-20	2,906	71	9	7.4	20.5	3.1	.02	22	7.3	6.6	64	31	8.0	.1	3.8	117	85	32
Sept. 21-30	6,446	71	10	6.8	16.7	4.0	.01	18	5.6	5.0	47	27	6.5	.1	3.5	98	68	29
Average	13,160	56	10	7.1	13.2	4.0	0.03	14	4.6	4.2	38	22	4.4	0.1	3.0	79	54	23

Delaware River at Morrisville, Pa.

(Records of discharge published as Delaware River at Trenton, N. J.)

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																	Total	Non-carbonate
Oct. 1-10, 1945	13,030	---	---	---	---	---	---	0.649	0.370	0.037	0.557	0.375	0.085	0.005	0.034	---	---	---
Oct. 11-20	16,360	---	---	---	---	---	---	.499	.255	.201	.475	.354	.085	.005	.036	---	---	---
Oct. 21-31	9,207	---	---	---	---	---	---	.649	.354	.137	.623	.396	.102	.005	.014	---	---	---
Nov. 1-10	11,260	---	---	---	---	---	---	.599	.312	.164	.557	.375	.102	.005	.036	---	---	---
Nov. 11-20	15,460	---	---	---	---	---	---	.499	.255	.164	.459	.333	.085	.005	.036	---	---	---
Nov. 21-30	25,770	---	---	---	---	---	---	.499	.247	.171	.410	.375	.096	.005	.031	---	---	---
Dec. 1-10	18,870	---	---	---	---	---	---	.549	.321	.154	.459	.416	.096	.005	.048	---	---	---
Dec. 11-20	11,900	---	---	---	---	---	---	.649	.354	.186	.557	.458	.116	.005	.053	---	---	---
Dec. 21-31	15,880	---	---	---	---	---	---	.699	.411	.205	.492	.562	.169	.005	.087	---	---	---
Jan. 1-10, 1946	23,740	---	---	---	---	---	---	.599	.321	.127	.492	.416	.073	.000	.066	---	---	---
Jan. 11-20	20,340	---	---	---	---	---	---	.499	.288	.154	.426	.375	.096	.005	.039	---	---	---
Jan. 21-31	9,552	---	---	---	---	---	---	.699	.403	.216	.672	.437	.127	.005	.077	---	---	---
Feb. 1-10	8,078	---	---	---	---	---	---	.749	.428	.251	.705	.500	.141	.005	.077	---	---	---
Feb. 11-20	8,252	---	---	---	---	---	---	.749	.403	.184	.672	.458	.135	.005	.066	---	---	---
Feb. 21-28	6,848	---	---	---	---	---	---	.749	.419	.247	.656	.521	.152	.005	.081	---	---	---
Mar. 1-10	26,300	---	---	---	---	---	---	.599	.263	.119	.426	.396	.099	.005	.055	---	---	---
Mar. 11-20	27,850	---	---	---	---	---	---	.474	.238	.085	.328	.333	.071	.005	.060	---	---	---
Mar. 21-31	16,620	---	---	---	---	---	---	.599	.321	.135	.459	.437	.102	.005	.052	---	---	---
Apr. 1-10	10,620	---	---	---	---	---	---	.649	.362	.170	.557	.458	.113	.011	.042	---	---	---
Apr. 11-20	8,149	---	---	---	---	---	---	.699	.386	.202	.656	.458	.124	.005	.044	---	---	---
Apr. 21-30	6,707	---	---	---	---	---	---	.749	.411	.176	.688	.479	.135	.005	.029	---	---	---
May 1-10	6,422	---	---	---	---	---	---	.749	.411	.160	.688	.458	.138	.005	.031	---	---	---
May 11-20	13,200	---	---	---	---	---	---	.649	.354	.145	.557	.437	.107	.005	.042	---	---	---
May 21-31	37,450	---	---	---	---	---	---	.409	.214	.124	.344	.312	.059	.005	.027	---	---	---
June 1-10	32,150	---	---	---	---	---	---	.469	.238	.189	.442	.354	.062	.011	.027	---	---	---
June 11-20	12,460	---	---	---	---	---	---	.649	.337	.213	.613	.416	.107	.005	.032	---	---	---
June 21-30	7,236	---	---	---	---	---	---	.798	.428	.171	.721	.479	.155	.005	.037	---	---	---
July 1-10	7,983	---	---	---	---	---	---	.848	.428	.160	.754	.500	.127	.005	.050	---	---	---
July 11-20	4,610	---	---	---	---	---	---	.948	.518	.213	.885	.562	.169	.005	.058	---	---	---
July 21-31	10,090	---	---	---	---	---	---	.749	.411	.185	.656	.500	.124	.005	.060	---	---	---
Aug. 1-10	5,823	---	---	---	---	---	---	.898	.485	.196	.787	.562	.175	.---	.055	---	---	---
Aug. 11-20	5,984	---	---	---	---	---	---	.848	.444	.240	.803	.521	.169	---	.039	---	---	---
Aug. 21-31	4,449	---	---	---	---	---	---	.948	.510	.301	.934	.583	.197	---	.045	---	---	---
Sept. 1-10	3,301	---	---	---	---	---	---	1.048	.584	.274	1.016	.625	.197	.005	.063	---	---	---
Sept. 11-20	2,906	---	---	---	---	---	---	1.098	.600	.288	1.049	.645	.226	.005	.061	---	---	---
Sept. 21-30	6,446	---	---	---	---	---	---	.898	.461	.217	.770	.562	.183	.005	.056	---	---	---
Average	13,160	---	---	---	---	---	---	0.699	0.378	0.181	0.623	0.458	0.124	0.005	0.048	---	---	---

Lehigh River at Catasauqua, Pa.

Chemical analyses, in parts per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10^6 at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate
Oct. 1-10, 1944---	432	57	6	7.1	25.4	5.0	0.02	0.7	27	9.3	6.5	3.0	35	79	3.8	0.1	3.7	169	106	77
Oct. 11-20--------	416	53	6	7.1	25.2	5.0	.03	.7	26	9.5	7.1	3.2	35	78	3.8	.1	4.8	157	104	75
Oct. 21-31--------	489	47	4	6.8	22.0	5.0	.01	.6	23	7.8	6.2	2.5	23	71	3.2	.2	3.4	136	89	71
Nov. 1-10---------	414	48	4	7.1	25.2	5.0	.02	.6	25	9.1	6.8	2.7	36	76	4.6	.1	4.7	154	100	70
Nov. 11-20--------	476	46	3	6.9	22.1	3.6	.02	.8	21	8.1	6.3	2.2	20	74	4.2	.1	4.5	136	86	69
Nov. 21-30--------	752	40	6	7.0	18.1	3.4	.02	.6	18	6.3	4.3	1.5	18	59	2.9	.0	2.5	109	71	56
Dec. 1-10---------	1,364	35	3	7.0	13.7	4.5	.02	.4	13	4.5	3.3	1.1	10	44	2.4	.1	2.8	85	51	43
Dec. 11-20--------	1,627	35	5	6.5	12.0	5.0	.02	.3	12	4.1	3.0	1.0	10	40	2.5	.1	2.6	77	47	39
Dec. 21-31--------	940	32	3	6.2	14.0	5.5	.02	.3	13	4.9	2.9	1.2	8	49	2.8	.1	2.8	90	53	46
Jan. 1-10, 1945----	1,619	32	4	6.4	12.2	5.2	.03	.2	11	3.6	3.9	1.0	6	41	2.0	.1	2.4	79	42	37
Jan. 11-20--------	971	32	5	6.4	13.9	5.0	.01	.3	14	4.7	3.3	.8	9	48	2.6	.1	2.3	88	54	47
Jan. 21-31--------	759	32	5	6.6	15.9	5.5	.01	.4	16	5.3	3.9	1.3	12	53	3.0	.1	2.3	100	62	52
Feb. 1-10---------	690	33	5	6.6	16.7	5.4	.01	.4	16	5.6	5.1	.8	12	57	2.9	.1	2.2	105	63	53
Feb. 11-20--------	972	34	5	6.7	15.5	4.9	.02	.3	15	5.0	3.8	1.0	11	51	3.1	.1	2.7	95	58	49
Feb. 21-28--------	3,360	34	5	6.7	12.5	4.6	.02	.2	13	3.9	3.0	1.0	10	38	2.5	.1	4.0	76	48	40
Mar. 1-10---------	5,484	40	6	5.8	8.33	4.6	.06	.1	7.9	2.8	1.7	.4	2	26	1.8	.1	2.1	55	31	30
Mar. 11-20--------	3,565	44	6	5.7	7.93	3.7	.02	.2	7.2	2.8	2.1	.6	4	27	1.9	.1	1.1	51	29	26
Mar. 21-31--------	2,743	51	5	5.9	8.51	4.3	.04	.2	7.5	2.8	2.4	.6	5	29	1.5	.1	1.1	53	30	26
Apr. 1-10---------	3,266	52	13	6.0	8.61	3.7	.03	.2	7.7	2.7	2.0	1.0	4	29	1.8	.1	1.5	54	30	27
Apr. 11-20--------	2,032	56	7	6.1	9.63	3.9	.01	.2	8.6	3.2	2.6	.9	5	33	2.0	.1	1.3	60	35	30
Apr. 21-30--------	1,847	51	6	6.1	9.94	3.6	.02	.3	9.6	3.3	2.4	.7	6	34	1.5	.1	1.2	62	38	33
May 1-10----------	2,314	52	6	6.1	8.89	3.4	.02	.1	7.5	2.8	2.7	.8	4	30	1.8	.1	1.1	55	30	27
May 11-20---------	3,502	56	7	6.1	8.15	3.3	.03	.2	7.7	2.5	2.1	.8	4	26	1.9	.1	1.3	50	30	26
May 21-31---------	2,219	59	7	6.1	9.21	4.0	.01	.3	8.1	3.1	2.0	.9	6	29	2.0	.0	.9	59	33	28
June 1-10---------	2,340	56	6	6.1	8.60	4.4	.02	.3	8.4	2.7	1.8	.7	7	27	1.8	.1	.8	54	32	26
June 11-20--------	1,895	69	8	6.3	10.1	4.1	.03	.4	9 5	3.2	2.7		7	32	2.1	.1	1.5	63	37	31
June 21-30--------	1,975	70	12	6.4	10.1	4.4	.04	.4	9.4	3.1	2.6		8	32	1.8	.1	1.6	64	36	30
July 1-10---- ----	2,671	70	13	6.5	11.4	4.4	.06	.3	11	3.5	3.3	1.5	9	37	2.1	.2	1.8	75	42	34
July 11-20--------	6,941	65	12	6.4	10.7	5.1	.08	.1	10	2.8	2.6	1.2	10	32	2.1	.1	2.8	72	36	28
July 21-31--------	5,605	66	12	6.2	9.44	4.8	.07	.2	8.7	3.1	2.1	1.1	8	30	1.8	.1	1.5	61	34	28
Aug. 1-10---------	2,676	66	8	6.3	10.5	5.2	.04	.1	9.9	3.6	2.2	.9	6	34	1.8	.1	1.6	65	40	35
Aug. 11-20--------	1,441	68	8	6.2	13.0	5.3	.02	.3	12	4.4	2.5	1.3	7	41	2.4	.1	1.7	81	48	42
Aug. 21-31--------	1,819	67	10	6.5	12.2	4.6	.05	.3	11	4.2	2.6	1.4	9	39	2.1	.1	1.6	75	45	37
Sept. 1-10--------	1,356	70	4	6.5	13.8	5.7	.03	.2	13	4.7	3.2	1.6	14	44	2.3	.1	2.9	93	52	40
Sept. 11-20-------	3,037	63	10	6.5	11.7	5.4	.03	.2	11	3.6	3.5	1.2	10	34	2.6	.1	2.4	75	42	34
Sept. 21-30-------	2,524	60	--	6.3	11.2	5.6	.03	.4	11	3.6	2.3	1.2	6	37	1.0	.1	2.1	70	42	37
Average--------	2,126	51	7	6.4	13.2	4.6	0.03	0.3	13	4.5	3.4	1.3	11	43	2.4	0.1	2.3	83	51	42

Lehigh River at Catasauqua, Pa.

Chemical analyses, in equivalents per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate
Oct. 1-10, 1944	432	---	---	---	---	---	---	---	1.348	0.765	0.283	0.077	0.574	1.645	0.107	0.005	0.060	---	---	---
Oct. 11-20	416	---	---	---	---	---	---	---	1.298	.781	.309	.082	.574	1.624	.107	.005	.077	---	---	---
Oct. 21-31	489	---	---	---	---	---	---	---	1.148	.641	.270	.064	.377	1.478	.090	.011	.055	---	---	---
Nov. 1-10	414	---	---	---	---	---	---	---	1.248	.748	.296	.069	.590	1.582	.130	.005	.076	---	---	---
Nov. 11-20	476	---	---	---	---	---	---	---	1.048	.666	.274	.056	.328	1.541	.118	.005	.073	---	---	---
Nov. 21-30	752	---	---	---	---	---	---	---	.898	.518	.187	.038	.295	1.228	.082	.000	.040	---	---	---
Dec. 1-10	1,364	---	---	---	---	---	---	---	.649	.370	.144	.028	.164	.916	.068	.005	.045	---	---	---
Dec. 11-20	1,627	---	---	---	---	---	---	---	.599	.337	.130	.026	.164	.873	.071	.005	.042	---	---	---
Dec. 21-31	940	---	---	---	---	---	---	---	.649	.403	.126	.031	.131	1.020	.079	.005	.045	---	---	---
Jan. 1-10, 1945	1,619	---	---	---	---	---	---	---	.549	.296	.170	.026	.098	.854	.056	.005	.039	---	---	---
Jan. 11-20	971	---	---	---	---	---	---	---	.699	.387	.144	.020	.148	.990	.073	.005	.037	---	---	---
Jan. 21-31	759	---	---	---	---	---	---	---	.799	.436	.170	.033	.197	1.103	.085	.005	.037	---	---	---
Feb. 1-10	690	---	---	---	---	---	---	---	.799	.461	.222	.020	.197	1.187	.082	.005	.035	---	---	---
Feb. 11-20	972	---	---	---	---	---	---	---	.749	.411	.165	.026	.180	1.062	.087	.005	.044	---	---	---
Feb. 21-28	3,360	---	---	---	---	---	---	---	.649	.321	.130	.026	.164	.791	.071	.005	.065	---	---	---
Mar. 1-10	5,484	---	---	---	---	---	---	---	.394	.230	.074	.010	.033	.541	.051	.005	.034	---	---	---
Mar. 11-20	3,565	---	---	---	---	---	---	---	.389	.230	.091	.015	.066	.562	.054	.005	.018	---	---	---
Mar. 21-31	2,743	---	---	---	---	---	---	---	.374	.230	.104	.015	.082	.604	.042	.005	.018	---	---	---
Apr. 1-10	3,266	---	---	---	---	---	---	---	.384	.222	.087	.026	.066	.604	.051	.005	.024	---	---	---
Apr. 11-20	2,032	---	---	---	---	---	---	---	.429	.263	.113	.023	.082	.687	.056	.005	.021	---	---	---
Apr. 21-30	1,847	---	---	---	---	---	---	---	.479	.271	.104	.018	.098	.708	.042	.005	.019	---	---	---
May 1-10	2,314	---	---	---	---	---	---	---	.374	.230	.117	.020	.066	.625	.051	.005	.018	---	---	---
May 11-20	3,502	---	---	---	---	---	---	---	.384	.206	.091	.020	.066	.541	.054	.005	.021	---	---	---
May 21-31	2,219	---	---	---	---	---	---	---	.404	.255	.087	.023	.098	.604	.056	.000	.014	---	---	---
June 1-10	2,340	---	---	---	---	---	---	---	.419	.222	.078	.018	.115	.562	.051	.005	.013	---	---	---
June 11-20	1,895	---	---	---	---	---	---	---	.474	.263	0.117		.115	.666	.059	.005	.024	---	---	---
June 21-30	1,975	---	---	---	---	---	---	---	.469	.255	.113		.131	.666	.051	.005	.026	---	---	---
July 1-10	2,671	---	---	---	---	---	---	---	.549	.288	.144	.038	.147	.770	.059	.011	.029	---	---	---
July 11-20	6,941	---	---	---	---	---	---	---	.499	.230	.113	.031	.164	.666	.059	.005	.045	---	---	---
July 21-31	5,605	---	---	---	---	---	---	---	.434	.255	.091	.028	.131	.625	.051	.005	.024	---	---	---
Aug. 1-10	2,676	---	---	---	---	---	---	---	.494	.313	.096	.023	.098	.708	.051	.005	.026	---	---	---
Aug. 11-20	1,441	---	---	---	---	---	---	---	.599	.362	.109	.033	.115	.854	.068	.005	.027	---	---	---
Aug. 21-31	1,819	---	---	---	---	---	---	---	.549	.345	.113	.036	.147	.812	.059	.005	.026	---	---	---
Sept. 1-10	1,356	---	---	---	---	---	---	---	.649	.386	.139	.041	.229	.916	.065	.005	.047	---	---	---
Sept. 11-20	3,037	---	---	---	---	---	---	---	.549	.296	.152	.031	.164	.708	.073	.005	.039	---	---	---
Sept. 21-30	2,524	---	---	---	---	---	---	---	.549	.296	.100	.031	.098	.770	.028	.005	.034	---	---	---
Average	2,126	---	---	---	---	---	---	---	0.649	0.370	0.148	0.033	0.180	0.895	0.068	0.005	0.037	---	---	---

MERCE
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Lehigh River at Catasauqua, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																		Total	Non-carbonate
Oct. 1-10, 1945	2,073	54	8	6.5	12.0	5.0	0.03	0.20	11	4.0	3.4	8	38	2.5	0.1	1.6	74	44	37
Oct. 11-20	2,268	50	10	6.4	10.3	4.5	.03	.00	9.0	3.3	4.6	9	33	2.2	.1	1.2	63	36	29
Oct. 21-31	1,371	50	3	6.2	12.7	5.1	.01	.32	11	4.3	5.9	11	42	2.5	.1	1.8	78	45	36
Nov. 1-10	1,262	47	8	6.5	12.3	4.7	.03	.42	12	4.0	3.3	10	39	2.4	.1	1.4	74	46	38
Nov. 11-20	1,782	47	8	6.3	10.4	4.3	.02	.39	9.7	3.3	3.6	10	32	2.1	.0	1.4	62	38	30
Nov. 21-30	3,584	39	4	6.5	8.69	4.5	.02	.05	7.4	2.3	4.8	9	25	2.2	.1	2.0	52	28	21
Dec. 1-10	3,064	37	7	6.4	8.80	4.2	.02	.20	8.4	3.0	2.5	7	27	2.1	.1	2.1	57	33	28
Dec. 11-20	2,030	31	5	6.8	10.7	4.9	.02	.35	10	3.6	4.3	10	34	2.6	.1	2.1	68	40	32
Dec. 21-31	2,491	31	7	6.7	11.3	4.6	.01	.22	12	3.5	3.0	12	34	2.4	.1	2.5	68	44	34
Jan. 1-10, 1946	3,782	37	9	6.8	9.36	4.1	.02	.15	9.1	3.1	3.0	11	26	2.2	.0	3.6	58	35	26
Jan. 11-20	2,878	34	6	6.5	9.36	3.9	.02	---	7.9	3.0	4.0	8	28	2.2	.1	2.0	60	32	26
Jan. 21-31	1,587	32	3	7.0	12.5	4.3	.01	.20	12	4.0	5.9	20	36	2.2	.1	2.5	75	46	30
Feb. 1-10	1,255	32	2	6.9	14.1	4.9	.02	.28	13	4.8	4.3	16	40	3.2	.1	2.6	85	52	39
Feb. 11-20	1,169	34	2	7.0	14.1	4.6	.02	.15	13	4.4	4.9	15	40	3.5	.1	2.6	84	51	38
Feb. 21-28	1,125	33	12	7.0	14.8	4.4	.02	.35	15	4.7	6.0	22	44	2.5	.1	2.6	89	57	39
Mar. 1-10	3,160	38	9	6.6	9.74	4.3	.04	.10	9.7	2.5	3.8	10	27	2.5	.1	3.3	59	34	26
Mar. 11-20	3,403	42	7	6.4	7.59	4.3	.04	---	6.7	2.3	3.1	6	23	1.8	.1	1.4	47	26	21
Mar. 21-31	2,855	48	5	6.9	9.03	3.9	.03	.15	8.6	2.9	3.4	10	27	2.0	.1	1.9	55	33	25
Apr. 1-10	1,867	46	5	6.8	10.9	3.4	.02	.20	9.6	3.4	4.3	8	34	2.5	.1	2.0	67	38	31
Apr. 11-20	1,284	48	20	6.8	12.9	3.2	.02	.19	12	4.0	5.7	14	41	2.1	.1	1.7	80	46	35
Apr. 21-30	1,032	53	4	6.8	14.4	4.3	.02	.42	14	4.4	5.5	16	45	2.5	.1	1.6	91	53	40
May 1-10	909	55	3	7.1	14.6	4.1	.02	.36	14	4.6	5.7	13	48	2.9	.1	1.7	91	54	43
May 11-20	1,997	58	5	6.7	11.9	3.7	.03	.20	12	3.6	4.5	14	37	2.1	.1	1.7	73	45	33
May 21-31	6,832	59	10	6.2	7.99	3.8	.08	.14	7.2	2.6	3.1	6	26	1.6	.1	1.1	55	29	24
June 1-10	4,659	59	3	6.4	8.58	4.5	.02	.20	8.3	3.1	3.3	6	31	1.8	.1	.8	66	33	29
June 11-20	2,200	64	3	6.7	11.5	5.1	.03	.13	11	3.7	3.8	9	38	1.9	.1	1.3	72	43	35
June 21-30	1,349	68	2	6.8	14.6	5.0	.02	.38	15	5.0	4.6	16	47	2.8	.1	2.1	92	58	45
July 1-10	1,489	71	3	7.1	17.7	5.5	.02	.25	20	5.4	4.4	26	51	2.6	.1	4.1	127	72	51
July 11-20	847	73	3	7.1	19.5	5.5	.01	.35	19	6.4	6.1	21	60	2.9	.1	3.6	119	74	56
July 21-31	2,342	70	7	6.7	15.1	5.1	.06	.03	15	4.7	4.3	16	45	2.5	---	3.2	96	57	44
Aug. 1-10	1,034	69	2	6.8	17.3	4.8	.01	.18	16	6.0	6.0	15	55	3.8	---	3.4	108	65	52
Aug. 11-20	1,217	69	3	6.8	17.6	4.9	.02	.23	17	6.0	5.1	15	56	3.5	---	3.1	109	67	55
Aug. 21-31	887	66	3	6.9	19.1	5.3	.01	.12	18	6.4	7.1	21	59	3.8	---	3.4	120	71	54
Sept. 1-10	595	66	8	7.1	22.8	5.7	.02	.65	22	7.7	8.2	23	74	3.6	---	4.3	146	87	68
Sept. 11-20	555	66	8	6.8	24.0	5.5	.02	.55	24	8.2	8.1	24	78	4.0	.1	5.5	152	94	74
Sept. 21-30	1,290	66	10	6.7	16.8	4.9	.02	.48	16	5.2	6.7	17	53	3.1	.1	2.8	104	61	47
Average	2,059	51	6	6.7	13.2	4.6	0.02	0.25	13	4.3	4.2	13	41	2.6	0.1	2.4	83	50	40

Lehigh River at Catasauqua, Pa.

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10^6 at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate
Oct. 1-10, 1945	2,073	---	---	---	---	---	---	---	0.549	0.389	0.146	0.131	0.791	0.071	0.005	0.026	---	---	---
Oct. 11-20	2,268	---	---	---	---	---	---	---	.449	.271	.200	.147	.687	.062	.005	.019	---	---	---
Oct. 21-31	1,371	---	---	---	---	---	---	---	.549	.354	.255	.180	.874	.070	.005	.029	---	---	---
Nov. 1-10	1,282	---	---	---	---	---	---	---	.599	.329	.144	.164	.812	.068	.005	.023	---	---	---
Nov. 11-20	1,782	---	---	---	---	---	---	---	.484	.271	.157	.164	.666	.059	.000	.023	---	---	---
Nov. 21-30	3,564	---	---	---	---	---	---	---	.369	.189	.209	.147	.521	.062	.005	.032	---	---	---
Dec. 1-10	3,064	---	---	---	---	---	---	---	.419	.247	.109	.115	.562	.059	.005	.034	---	---	---
Dec. 11-20	2,030	---	---	---	---	---	---	---	.499	.296	.189	.164	.708	.073	.005	.034	---	---	---
Dec. 21-31	2,491	---	---	---	---	---	---	---	.599	.288	.131	.197	.708	.068	.005	.040	---	---	---
Jan. 1-10, 1946	3,782	---	---	---	---	---	---	---	.454	.255	.132	.180	.541	.062	.000	.058	---	---	---
Jan. 11-20	2,878	---	---	---	---	---	---	---	.394	.247	.172	.131	.583	.062	.005	.032	---	---	---
Jan. 21-31	1,587	---	---	---	---	---	---	---	.599	.329	.257	.328	.750	.062	.005	.040	---	---	---
Feb. 1-10	1,295	---	---	---	---	---	---	---	.649	.395	.188	.262	.833	.090	.005	.042	---	---	---
Feb. 11-20	1,169	---	---	---	---	---	---	---	.649	.362	.214	.246	.833	.099	.005	.042	---	---	---
Feb. 21-28	1,125	---	---	---	---	---	---	---	.749	.386	.259	.361	.916	.070	.005	.042	---	---	---
Mar. 1-10	3,160	---	---	---	---	---	---	---	.484	.206	.165	.164	.562	.071	.005	.053	---	---	---
Mar. 11-20	3,103	---	---	---	---	---	---	---	.334	.189	.133	.098	.479	.051	.005	.023	---	---	---
Mar. 21-31	2,655	---	---	---	---	---	---	---	.429	.239	.150	.164	.562	.056	.005	.031	---	---	---
Apr. 1-10	1,867	---	---	---	---	---	---	---	.479	.280	.188	.131	.708	.071	.005	.032	---	---	---
Apr. 11-20	1,284	---	---	---	---	---	---	---	.599	.329	.246	.229	.854	.059	.005	.027	---	---	---
Apr. 21-30	1,032	---	---	---	---	---	---	---	.699	.362	.240	.262	.937	.071	.005	.026	---	---	---
May 1-10	909	---	---	---	---	---	---	---	.699	.378	.249	.213	.999	.082	.005	.027	---	---	---
May 11-20	1,997	---	---	---	---	---	---	---	.599	.296	.195	.229	.770	.059	.005	.027	---	---	---
May 21-31	3,832	---	---	---	---	---	---	---	.359	.214	.134	.098	.541	.045	.005	.018	---	---	---
June 1-10	4,659	---	---	---	---	---	---	---	.414	.255	.143	.098	.645	.051	.005	.013	---	---	---
June 11-20	2,900	---	---	---	---	---	---	---	.549	.304	.165	.147	.791	.054	.005	.021	---	---	---
June 21-30	1,349	---	---	---	---	---	---	---	.749	.411	.199	.262	.979	.079	.005	.034	---	---	---
July 1-10	1,489	---	---	---	---	---	---	---	.898	.444	.190	.426	1.062	.073	.005	.066	---	---	---
July 11-20	647	---	---	---	---	---	---	---	.948	.526	.264	.344	1.249	.082	.005	.058	---	---	---
July 21-31	2,342	---	---	---	---	---	---	---	.749	.387	.186	.262	.937	.071	---	.052	---	---	---
Aug. 1-10	1,034	---	---	---	---	---	---	---	.798	.493	.262	.246	1.145	.107	---	.055	---	---	---
Aug. 11-20	1,217	---	---	---	---	---	---	---	.848	.493	.220	.246	1.166	.099	---	.050	---	---	---
Aug. 21-31	887	---	---	---	---	---	---	---	.898	.526	.310	.344	1.228	.107	---	.055	---	---	---
Sept. 1-10	595	---	---	---	---	---	---	---	1.098	.633	.358	.377	1.541	.102	---	.069	---	---	---
Sept. 11-20	555	---	---	---	---	---	---	---	1.198	.674	.352	.393	1.624	.113	.005	.089	---	---	---
Sept. 21-30	1,290	---	---	---	---	---	---	---	.798	.428	.293	.279	1.103	.087	.005	.045	---	---	---
Average	2,059	---	---	---	---	---	---	---	0.649	0.354	0.181	0.213	0.854	0.073	0.005	0.039	---	---	---

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Schuylkill River at Pottstown, Pa.

Chemical analyses, in parts per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																			Total	Non-carbonate
Oct. 1-10, 1944	448	60	5	6.9	51.0	8.2	0.03	---	55	22	15	3.4	48	185	12	0.2	3.6	373	228	188
Oct. 11-20	439	55	3	7.0	56.4	8.2	.02	0.0	59	27	14	3.4	45	221	11	.1	6.6	393	258	221
Oct. 21-31	574	50	3	6.8	48.8	7.6	.04	.0	49	21	14	3.9	40	178	9.9	.2	5.2	328	209	176
Nov. 1-10	411	51	3	7.0	49.6	8.8	.02	.0	51	21	15	3.9	56	171	10	.2	6.9	332	214	168
Nov. 11-20	451	47	4	7.0	48.5	6.2	.02	.0	51	21	14	2.9	52	172	11	.0	6.7	328	214	171
Nov. 21-30	1,472	41	6	6.8	38.7	6.0	.03	.0	39	16	12	2.7	44	129	8.5	.0	4.6	251	163	127
Dec. 1-10	2,245	37	5	6.5	25.4	7.4	.02	.0	26	10	7.1	2.6	24	90	5.8	.1	1.8	164	106	86
Dec. 11-20	2,469	36	5	6.5	24.5	8.0	.03	.0	25	9.7	6.2	2.2	24	85	6.2	.1	3.8	159	102	83
Dec. 21-31	1,175	33	5	6.7	32.8	9.4	.02	.0	34	14	9.0	2.6	36	112	7.2	.1	7.5	216	142	113
Jan. 1-10, 1945	2,309	33	8	6.7	26.8	8.2	.02	.0	28	11	7.1	2.6	32	85	6.5	.1	6.1	174	115	89
Jan. 11-20	984	34	4	6.7	35.6	8.8	.02	.0	36	14	12	1.0	38	115	9.0	.1	7.9	232	147	116
Jan. 21-31	714	32	3	6.8	40.0	9.0	.02	.0	42	17	12	1.6	52	127	8.9	.1	9.1	263	175	132
Feb. 1-10	660	34	5	6.7	42.5	9.0	.03	.1	45	18	13	1.8	56	136	10	.1	13	282	186	140
Feb. 11-20	1,935	37	2	6.9	31.4	7.2	.02	.0	32	12	9.9	1.8	41	98	8.2	.2	4.7	200	129	96
Feb. 21-28	5,790	37	2	6.8	20.7	6.0	.02	.0	21	7.4	6.1	1.7	28	62	5.0	.1	2.8	124	83	60
Mar. 1-10	5,675	41	6	6.7	18.5	5.2	.02	.0	20	7.1	4.3	.8	22	61	3.8	.2	4.1	119	79	61
Mar. 11-20	2,364	49	2	6.6	26.6	7.2	.02	.0	27	11	6.8	1.3	32	87	5.1	.1	3.2	174	113	86
Mar. 21-31	2,094	55	1	6.7	27.7	7.0	.01	.0	28	11	7.6	1.5	30	92	5.1	.1	4.6	178	115	90
Apr. 1-10	2,811	55	5	6.5	25.0	7.8	.01	.0	25	10	6.8	1.4	28	84	4.0	.1	3.1	162	104	80
Apr. 11-20	1,976	60	4	6.7	30.4	6.8	.02	.0	30	12	7.8	1.0	27	109	5.5	.1	3.9	198	124	102
Apr. 21-30	1,828	53	8	6.8	30.7	6.0	.02	.0	32	13	7.9	1.0	28	110	5.0	.1	4.7	202	133	110
May 1-10	2,809	53	9	6.6	24.6	7.2	.03	---	24	10	5.9	1.8	26	82	4.2	.1	2.8	161	101	80
May 11-20	4,151	59	7	6.5	20.1	7.2	.03	---	20	8.4	4.2	1.4	20	67	3.5	.1	2.4	131	84	68
May 21-31	2,301	63	9	6.5	28.0	8.2	.03	.1	27	12	5.9	1.4	21	103	4.5	.1	2.6	186	117	100
June 1-10	1,570	60	4	6.5	32.2	7.8	.02	.0	31	13	8.4	1.7	20	121	5.8	.1	3.1	216	131	114
June 11-20	1,581	75	7	6.6	32.9	8.0	.03	.0	33	13	7.9	2.3	26	120	6.0	.1	3.0	221	136	114
June 21-30	1,519	75	6	6.7	34.6	8.0	.01	.0	34	14	9.3	2.7	30	124	6.6	.1	3.6	228	142	118
July 1-10	1,227	76	6	6.5	37.2	8.8	.01	.0	37	16	8.5	2.0	31	137	5.5	.2	5.5	252	158	133
July 11-20	4,958	70	2	6.5	29.6	8.6	.02	.0	29	12	7.6	2.2	19	111	5.0	.1	1.7	197	122	106
July 21-31	4,607	70	3	6.5	27.1	8.8	.02	.0	27	11	5.4	2.0	16	100	3.5	.1	3.6	182	113	100
Aug. 1-10	2,408	70	3	6.6	34.0	8.4	.02	.0	34	15	6.8	1.9	20	128	5.2	.2	2.9	228	147	130
Aug. 11-20	1,385	72	3	6.5	42.2	8.0	.02	.3	42	20	8.8	1.6	21	163	5.4	.2	3.7	289	187	170
Aug. 21-31	1,800	70	3	6.3	39.0	7.4	.01	.1	38	18	9.6	2.8	25	150	6.2	.1	3.4	260	169	148
Sept. 1-10	1,512	71	3	6.6	40.4	8.4	.01	.0	41	19	10	2.9	34	152	5.8	.1	4.5	277	180	153
Sept. 11-20	5,575	66	7	6.7	24.6	6.0	.02	.0	25	9.3	6.4	2.4	28	78	4.5	.1	3.4	155	101	78
Sept. 21-30	3,266	64	---	6.6	28.2	9.2	.02	.0	30	11	5.5	1.6	26	97	4.5	.2	3.8	181	120	99
Average	2,208	54	5	6.7	33.5	7.7	0.02	0.0	34	14	8.8	2.1	32	118	6.5	0.1	4.6	223	142	116

Chemical analyses, in equivalents per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																			Total	Non-carbonate
Oct. 1-10, 1944	448	---	---	---	---	---	---	---	2.745	1.809	0.652	0.087	0.787	3.852	0.338	0.011	0.058	---	---	---
Oct. 11-20	439	---	---	---	---	---	---	---	2.945	2.220	.609	.087	.738	4.601	.310	.005	.106	---	---	---
Oct. 21-31	574	---	---	---	---	---	---	---	2.446	1.727	.609	.100	.656	3.706	.279	.011	.084	---	---	---
Nov. 1-10	411	---	---	---	---	---	---	---	2.546	1.727	.652	.100	.918	3.560	.282	.011	.111	---	---	---
Nov. 11-20	451	---	---	---	---	---	---	---	2.546	1.727	.609	.074	.852	3.581	.310	.000	.108	---	---	---
Nov. 21-30	1,472	---	---	---	---	---	---	---	1.947	1.316	.522	.069	.721	2.686	.240	.000	.074	---	---	---
Dec. 1-10	2,245	---	---	---	---	---	---	---	1.298	.822	.309	.066	.393	1.874	.164	.005	.029	---	---	---
Dec. 11-20	2,469	---	---	---	---	---	---	---	1.248	.798	.270	.056	.393	1.770	.175	.005	.061	---	---	---
Dec. 21-31	1,175	---	---	---	---	---	---	---	1.697	1.151	.391	.066	.590	2.332	.203	.005	.121	---	---	---
Jan. 1-10, 1945	2,309	---	---	---	---	---	---	---	1.398	.905	.309	.066	.524	1.770	.183	.005	.098	---	---	---
Jan. 11-20	984	---	---	---	---	---	---	---	1.797	1.151	.522	.026	.623	2.394	.254	.005	.127	---	---	---
Jan. 21-31	714	---	---	---	---	---	---	---	2.096	1.398	.522	.041	.852	2.644	.251	.005	.147	---	---	---
Feb. 1-10	660	---	---	---	---	---	---	---	2.246	1.480	.565	.046	.918	2.832	.282	.005	.210	---	---	---
Feb. 11-20	1,935	---	---	---	---	---	---	---	1.597	.987	.430	.046	.672	2.040	.231	.011	.076	---	---	---
Feb. 21-28	5,790	---	---	---	---	---	---	---	1.048	.609	.265	.043	.459	1.291	.141	.005	.045	---	---	---
Mar. 1-10	5,675	---	---	---	---	---	---	---	.998	.584	.187	.020	.361	1.270	.107	.011	.066	---	---	---
Mar. 11-20	2,364	---	---	---	---	---	---	---	1.348	.905	.296	.033	.524	1.811	.144	.005	.052	---	---	---
Mar. 21-31	2,094	---	---	---	---	---	---	---	1.398	.905	.330	.038	.492	1.915	.144	.005	.074	---	---	---
Apr. 1-10	2,811	---	---	---	---	---	---	---	1.248	.822	.296	.036	.459	1.749	.113	.005	.050	---	---	---
Apr. 11-20	1,976	---	---	---	---	---	---	---	1.497	.987	.339	.026	.443	2.269	.155	.005	.063	---	---	---
Apr. 21-30	1,828	---	---	---	---	---	---	---	1.597	1.069	.344	.026	.459	2.290	.141	.005	.076	---	---	---
May 1-10	2,809	---	---	---	---	---	---	---	1.198	.822	.217	.046	.426	1.707	.118	.005	.045	---	---	---
May 11-20	4,151	---	---	---	---	---	---	---	.998	.691	.183	.036	.328	1.395	.099	.005	.039	---	---	---
May 21-31	2,301	---	---	---	---	---	---	---	1.347	.987	.257	.036	.344	2.144	.127	.005	.042	---	---	---
June 1-10	1,570	---	---	---	---	---	---	---	1.547	1.069	.365	.043	.328	2.519	.164	.005	.050	---	---	---
June 11-20	1,581	---	---	---	---	---	---	---	1.647	1.069	.344	.059	.426	2.498	.169	.005	.048	---	---	---
June 21-30	1,519	---	---	---	---	---	---	---	1.697	1.151	---	.069	.492	2.582	.186	.005	.058	---	---	---
July 1-10	1,227	---	---	---	---	---	---	---	1.846	1.316	.370	.051	.508	2.852	.155	.011	.089	---	---	---
July 11-20	4,958	---	---	---	---	---	---	---	1.447	.987	.330	.056	.311	2.311	.141	.005	.027	---	---	---
July 21-31	4,607	---	---	---	---	---	---	---	1.347	.905	.235	.051	.262	2.082	.099	.005	.058	---	---	---
Aug. 1-10	2,408	---	---	---	---	---	---	---	1.697	1.234	.296	.049	.328	2.665	.147	.011	.047	---	---	---
Aug. 11-20	1,385	---	---	---	---	---	---	---	2.096	1.645	.383	.041	.344	3.304	.152	.011	.060	---	---	---
Aug. 21-31	1,800	---	---	---	---	---	---	---	1.896	1.480	.417	.072	.410	3.123	.175	.005	.055	---	---	---
Sept. 1-10	1,512	---	---	---	---	---	---	---	2.046	1.562	.435	.074	.557	3.165	.164	.005	.073	---	---	---
Sept. 11-20	5,575	---	---	---	---	---	---	---	1.248	.765	.278	.061	.459	1.624	.127	.005	.055	---	---	---
Sept. 21-30	3,266	---	---	---	---	---	---	---	1.497	.905	.239	.041	.426	2.020	.127	.011	.061	---	---	---
Average	2,208	-	---	---	---	---	---	---	1.697	1.151	0.383	0.054	0.524	2.457	0.183	0.005	0.074	---	---	---

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MERCE
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Schuylkill River at Pottstown, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate
Oct. 1-10, 1945---	1,979	57	8	6.6	34.8	8.8	0.02	——	35	15	6.0	24	126	5.2	0.1	4.7	226	149	129
Oct. 11-20--------	1,923	52	5	6.8	31.8	7.4	.04	0.00	31	13	8.6	26	111	6.0	.1	4.8	209	131	110
Oct. 21-31--------	1,171	53	5	6.7	40.2	7.6	.04	.00	40	18	9.1	32	147	6.5	.1	6.0	270	174	148
Nov. 1-10---------	980	51	3	6.7	42.2	8.0	.01	.00	42	19	11	38	153	7.8	.1	6.7	280	183	152
Nov. 11-20--------	1,346	49	8	6.8	37.2	7.8	.03	.00	38	15	10	34	132	6.5	.1	5.4	242	156	128
Nov. 21-30--------	4,328	42	5	6.7	22.8	7.6	.02	.00	22	8.8	6.3	24	73	4.4	.1	3.2	141	91	71
Dec. 1-10---------	4,024	40	4	6.9	21.9	9.6	.04	.00	22	9.1	5.0	28	68	4.2	.1	4.0	139	92	69
Dec. 11-20--------	2,111	34	4	6.9	29.4	8.0	.04	.00	29	13	6.5	32	96	6.0	.1	6.3	189	126	100
Dec. 21-31--------	2,658																		
Jan. 1-10, 1946---	3,743	41	5	6.8	22.2	7.8	.01	.07	23	8.8	4.5	31	64	4.5	.1	5.9	139	94	68
Jan. 11-20--------	2,778	37	6	6.8	26.6	7.8	.01	.06	26	11	8.0	30	87	5.1	.1	6.1	166	110	86
Jan. 21-31--------	1,622	34	6	7.0	31.1	7.0	.01	.02	34	14	9.4	42	108	7.0	.1	7.4	213	142	108
Feb. 1-10---------	1,393	35	4	6.9	35.4	7.2	.03	.00	35	14	11	42	108	9.0	.1	10	228	145	110
Feb. 11-20--------	1,285	37	5	7.0	35.1	7.2	.05	.30	34	14	11	48	104	9.2	.2	7.1	222	142	103
Feb. 21-28--------	1,395	36	2	7.8	36.3	7.8	.03	.02	36	15	12	54	110	9.4	.1	7.6	238	152	107
Mar. 1-10---------	3,250	42	3	6.9	22.6	7.0	.05	.00	23	8.7	5.9	33	65	5.1	.1	4.7	149	93	66
Mar. 11-20--------	3,370	47	7	6.7	22.6	7.6	.01	.00	22	8.7	6.7	28	70	4.5	.1	3.6	140	91	68
Mar. 21-31--------	3,484	50	3	6.9	22.9	6.6	.04	.00	24	9.2	5.6	28	73	5.0	.1	4.6	140	98	75
Apr. 1-10---------	2,031	50	6	7.0	28.6	5.8	.04	.20	28	12	8.1	36	90	6.5	.1	5.2	182	119	90
Apr. 11-20--------	1,263	53	3	6.9	36.1	7.2	.03	.00	36	15	10	45	116	7.8	.1	6.6	233	152	115
Apr. 21-30--------	1,046	58	6	6.9	38.1	7.8	.02	.00	38	16	11	49	122	7.8	.2	6.6	252	161	120
May 1-10----------	898	58	5	7.2	40.5	8.6	.04	.00	41	17	11	50	135	8.8	.2	2.8	268	172	131
May 11-20---------	2,111	62	10	6.7	32.0	6.4	.03	.00	31	13	10	40	104	6.6	.1	2.4	217	131	98
May 21-31---------	5,970	63	4	6.4	21.0	7.0	.03	.02	20	8.3	5.3	14	75	3.2	.1	1.7	134	84	73
June 1-10---------	6,169	62	3	6.8	21.9	7.8	.04	.20	22	9.8	7.2	23	80	3.2	.2	4.4	161	95	76
June 11-20--------	2,415	68	2	6.8	31.7	9.2	.02	.02	31	14	9.2	32	112	5.4	.2	4.8	206	135	109
June 21-30--------	1,378	71	2	6.9	39.2	7.8	.03	.00	40	17	13	42	142	7.8	.1	4.8	268	170	135
July 1-10---------	1,340	75	2	7.0	38.8	6.4	.02	.00	38	16	6.5	33	128	6.8	.2	5.2	277	161	134
July 11-20--------	814	76	2	7.0	46.5	9.2	.02	.00	46	20	14	44	165	9.6	.1	7.1	310	197	161
July 21-31--------	1,698	74	5	6.7	35.6	8.4	.08	.05	36	16	7.9	24	134	7.0	---	4.7	242	156	136
Aug. 1-10---------	826	74	3	6.8	43.6	8.8	.04	.00	44	20	13	33	168	9.0	---	6.0	298	192	165
Aug. 11-20--------	1,061	71	7	6.9	42.0	7.2	.02	.00	42	18	11	39	146	9.0	---	7.2	281	179	147
Aug. 21-31--------	1,038	69	3	6.8	35.6	5.2	.02	.00	36	15	7.5	39	116	8.0	---	4.8	233	152	120
Sept. 1-10--------	620	68	10	6.9	42.8	8.4	.02	.00	44	19	13	44	154	8.9	---	8.4	293	188	152
Sept. 11-20-------	485	69	12	6.9	51.6	7.6	.04	.00	54	23	13	47	180	11	.2	7.4	354	229	191
Sept. 21-30-------	906	70	10	6.8	41.1	7.2	.04	---	43	17	9.6	35	146	9.1	.2	5.0	276	177	148
Average---------	2,093	55	5	6.8	33.7	7.6	0.03	0.03	34	14	9.8	36	115	6.9	0.1	5.5	223	142	113

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																		Total	Noncarbonate
Oct. 1-10, 1945	1,979	---	---	---	---	---	---	---	1.747	1.234	0.263	0.393	2.623	0.147	0.005	0.076	---	---	---
Oct. 11-20	1,923	---	---	---	---	---	---	---	1.547	1.069	.372	.426	2.311	.169	.005	.077	---	---	---
Oct. 21-31	1,171	---	---	---	---	---	---	---	1.996	1.480	.394	.524	3.061	.183	.005	.097	---	---	---
Nov. 1-10	980	---	---	---	---	---	---	---	2.096	1.562	.484	.623	3.186	.220	.005	.108	---	---	---
Nov. 11-20	1,346	---	---	---	---	---	---	---	1.896	1.234	.450	.557	2,748	.183	.005	.087	---	---	---
Nov. 21-30	4,328	---	---	---	---	---	---	---	1.098	.724	.272	.393	1.520	.124	.005	.052	---	---	---
Dec. 1-10	4,024	---	---	---	---	---	---	---	1.098	.748	.217	.459	1.416	.118	.005	.065	---	---	---
Dec. 11-20	2,111	---	---	---	---	---	---	---	1.447	1.069	.283	.524	1.999	.169	.005	.102	---	---	---
Dec. 21-31	2,658																		
Jan. 1-10, 1946	3,743	---	---	---	---	---	---	---	1.148	.724	.195	.508	1.332	.127	.005	.095	---	---	---
Jan. 11-20	2,778	---	---	---	---	---	---	---	1.297	.905	.348	.492	1.811	.144	.005	.098	---	---	---
Jan. 21-31	1,622	---	---	---	---	---	---	---	1.697	1.151	.410	.688	2.249	.197	.005	.119	---	---	---
Feb. 1-10	1,393	---	---	---	---	---	---	---	1.747	1.151	.459	.688	2.249	.254	.005	.161	---	---	---
Feb. 11-20	1,285	---	---	---	---	---	---	---	1.697	1.151	.489	.787	2.165	.200	.011	.114	---	---	---
Feb. 21-28	1,395	---	---	---	---	---	---	---	1.796	1.234	.538	.885	2.290	.265	.005	.123	---	---	---
Mar. 1-10	3,250	---	---	---	---	---	---	---	1.148	.716	.255	.541	1.353	.144	.005	.076	---	---	---
Mar. 11-20	3,370	---	---	---	---	---	---	---	1.098	.715	.293	.459	1.457	.127	.005	.058	---	---	---
Mar. 21-31	3,484	---	---	---	---	---	---	---	1.198	.757	.244	.459	1.520	.141	.005	.074	---	---	---
Apr. 1-10	2,031	---	---	---	---	---	---	---	1.397	.987	.352	.590	1.874	.183	.005	.084	---	---	---
Apr. 11-20	1,263	---	---	---	---	---	---	---	1.796	1.234	.453	.737	2.415	.220	.005	.106	---	---	---
Apr. 21-30	1,046	---	---	---	---	---	---	---	1.896	1.316	.468	.803	2.540	.220	.011	.106	---	---	---
May 1-10	898	---	---	---	---	---	---	---	2.046	1.398	.490	.819	2.811	.248	.011	.045	---	---	---
May 11-20	2,111	---	---	---	---	---	---	---	1.547	1.069	.435	.656	2.165	.186	.005	.039	---	---	---
May 21-31	5,970	---	---	---	---	---	---	---	.998	.683	.232	.229	1.562	.090	.005	.027	---	---	---
June 1-10	6,169	---	---	---	---	---	---	---	1.098	.806	.311	.377	1.666	.090	.011	.071	---	---	---
June 11-20	2,415	---	---	---	---	---	---	---	1.547	1.151	.398	.524	2.332	.152	.011	.077	---	---	---
June 21-30	1,378	---	---	---	---	---	---	---	1.996	1.398	.552	.688	2.956	.220	.005	.077	---	---	---
July 1-10	1,340	---	---	---	---	---	---	---	1.896	1.316	.281	.541	2.665	.192	.011	.084	---	---	---
July 11-20	814	---	---	---	---	---	---	---	2.295	1.645	.607	.721	3.435	.271	.005	.115	---	---	---
July 21-31	1,698	---	---	---	---	---	---	---	1.796	1.316	.344	.393	2.790	.197	---	.076	---	---	---
Aug. 1-10	826	---	---	---	---	---	---	---	2.196	1.645	.549	.541	3.498	.254	---	.097	---	---	---
Aug. 11-20	1,061	---	---	---	---	---	---	---	2.096	1.480	.473	.639	3.040	.254	---	.116	---	---	---
Aug. 21-31	1,038	---	---	---	---	---	---	---	1.796	1.234	.327	.639	2.415	.226	---	.077	---	---	---
Sept. 1-10	620	---	---	---	---	---	---	---	2.196	1.562	.556	.721	3.206	.251	---	.136	---	---	---
Sept. 11-20	485	---	---	---	---	---	---	---	2.695	1.891	.559	.770	3.935	.310	.011	.119	---	---	---
Sept. 21-30	906	---	---	---	---	---	---	---	2.146	1.398	.419	.574	3.040	.257	.011	.081	---	---	---
Average	2,093	---	---	---	---	---	---	---	1.697	1.181	0.425	0.590	2.394	0.195	0.005	0.089	---	---	---

P38.42
2,10

MERCE

ROCEDURE

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Schuylkill River at Belmont Filter Plant, Philadelphia, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate
Oct. 1-10, 1945	2,422	59	9	7.6	34.8	16	0.06	---	36	16	6.0	50	106	9.5	0.1	4.7	226	156	115
Oct. 11-20	2,385	53	5	7.1	30.2	8.5	.07	---	30	13	9.3	43	96	7.0	---	4.3	186	128	93
Oct. 21-31	1,343	54	7	7.0	36.5	7.5	.04	---	37	16	11	54	117	8.0	---	5.6	226	158	114
Nov. 1-10	1,030	52	7	7.0	39.4	7.5	.04	---	39	17	14	62	123	9.0	---	6.5	250	167	116
Nov. 11-20	1,615	50	9	7.2	36.7	14	.04	---	37	16	12	64	112	8.0	---	5.4	232	158	106
Nov. 21-30	7,543	41	---	7.0	24.3	14	.18	---	23	9.9	9.4	48	64	6.0	---	5.2	152	98	59
Dec. 1-10	6,638	40	13	6.8	22.4	15	.09	---	23	8.6	9.1	46	59	6.5	.1	5.0	153	93	55
Dec. 11-20	2,999	36	8	6.9	28.6	19	.03	---	30	11	8.7	54	74	8.5	.1	6.9	191	120	76
Dec. 21-31	5,725	34	8	7.2	26.0	9.2	.04	---	27	11	5.4	44	69	7.0	.1	7.8	162	113	77
Jan. 1-10, 1946	6,766	38	10	7.2	21.4	8.8	.05	---	23	8.3	4.4	40	52	5.5	.1	7.6	139	92	59
Jan. 11-20	4,257	39	8	7.1	24.8	8.8	.05	---	26	9.4	8.0	42	68	7.0	.1	6.9	158	104	69
Jan. 21-31	1,992	33	5	7.6	30.8	7.5	.08	0.00	32	13	8.0	52	86	8.0	.1	8.7	200	133	91
Feb. 1-10	1,963	35	8	7.7	30.8	7.0	.05	.00	33	13	5.8	52	81	10	.1	9.0	197	136	93
Feb. 11-20	1,670	37	6	7.8	30.8	8.0	.05	.00	32	12	8.4	55	79	9.0	.1	9.0	197	129	84
Feb. 21-28	2,068	36	6	7.8	32.4	8.0	.05	.00	34	13	8.4	61	83	9.0	.1	9.0	202	138	88
Mar. 1-10	4,972	42	12	7.1	21.7	6.0	.05	.00	22	9.0	4.8	40	55	5.0	.2	5.8	131	92	59
Mar. 11-20	5,035	47	5	7.2	22.6	8.5	.05	.11	22	8.8	6.0	36	59	6.0	.2	5.2	140	91	62
Mar. 21-31	5,444	51	18	7.2	22.2	4.5	.07	.00	22	8.8	6.1	37	59	5.0	.2	6.4	137	91	61
Apr. 1-10	2,802	54	20	7.5	27.0	5.0	.06	.00	28	11	7.1	48	71	8.0	.1	7.1	166	115	76
Apr. 11-20	1,542	53	18	7.5	32.7	5.5	.06	.00	32	14	11	61	89	9.0	.1	8.0	202	137	87
Apr. 21-30	1,177	60	6	7.4	34.7	8.8	.02	.00	35	15	11	64	97	10	.1	6.6	228	149	97
May 1-10	913	60	10	7.4	36.9	6.4	.10	.00	36	15	14	74	97	12	.2	4.0	247	152	91
May 11-20	4,320	65	4	6.9	25.9	8.8	.04	.00	26	11	10	54	68	9.0	.2	4.8	193	110	66
May 21-31	7,527	67	10	6.9	21.3	7.2	.05	.00	22	8.4	5.5	28	63	7.0	.1	3.5	133	89	66
June 1-10	13,000	64	12	7.0	21.8	8.0	.05	.00	22	9.0	6.2	33	61	7.0	.2	5.4	139	92	65
June 11-20	3,584	70	7	7.1	27.9	10	.06	.00	28	12	7.8	43	82	8.0	.2	4.6	179	119	84
June 21-30	1,679	72	8	7.1	34.6	10	.06	.00	35	15	12	58	104	10	.2	6.1	222	149	102
July 1-10	1,422	78	8	7.3	33.6	8.4	.08	.00	33	14	15	51	111	7.0	---	5.5	224	140	98
July 11-20	714	79	7	7.5	39.9	11	.06	.00	39	18	13	64	120	12	---	7.5	266	171	119
July 21-31	4,368	77	12	7.1	27.6	10	.08	.00	26	12	8.4	40	80	8.0	---	6.3	182	114	81
Aug. 1-10	1,048	76	8	7.0	38.9	11	.04	.00	38	17	13	54	125	10	---	6.1	265	165	120
Aug. 1-20	1,217	75	2	7.6	38.8	7.2	.02	.00	41	16	8.6	62	113	10	---	5.3	252	168	117
Aug. 21-31	1,331	73	7	7.7	32.0	7.6	.02	.00	33	13	8.4	56	88	9.0	---	4.7	203	136	90
Sept. 1-10	699	71	7	7.6	36.6	6.0	.02	.04	37	15	10	61	103	10	---	5.4	236	154	104
Sept. 11-20	408	72	6	7.5	46.9	6.4	.02	.07	46	20	16	75	140	14	---	5.9	306	197	136
Sept. 21-30	998	73	7	7.5	39.6	7.6	.15	---	39	17	15	65	119	12	---	7.5	262	167	114
Average	3,498	56	9	7.3	30.9	9.0	0.06	---	31	13	9.5	52	88	8.5	0.1	6.2	200	131	88

Schuylkill River at Belmont Filter Plant, Philadelphia, Pa.

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate
Oct. 1-10, 1945	2,422	---	---	---	---	---	---	---	1.796	1.316	0.263	0.819	2.207	0.268	0.005	0.076	---	---	---
Oct. 11-20	2,385	---	---	---	---	---	---	---	1.497	1.069	.404	.705	1.999	.197	---	.069	---	---	---
Oct. 21-31	1,343	---	---	---	---	---	---	---	1.846	1.316	.475	.885	2,436	.226	---	.090	---	---	---
Nov. 1-10	1,030	---	---	---	---	---	---	---	1.946	1.398	.592	1.016	2.561	.254	---	.105	---	---	---
Nov. 11-20	1,615	---	---	---	---	---	---	---	1.846	1.316	.532	1.049	2.332	.226	---	.087	---	---	---
Nov. 21-30	7,543	---	---	---	---	---	---	---	1.148	.814	.410	.787	1.332	.169	---	.084	---	---	---
Dec. 1-10	6,638	---	---	---	---	---	---	---	1.148	.707	.396	.754	1.228	.183	.005	.081	---	---	---
Dec. 11-20	2,999	---	---	---	---	---	---	---	1.497	.905	.380	.885	1.541	.240	.005	.111	---	---	---
Dec. 21-31	5,725	---	---	---	---	---	---	---	1.347	.905	.234	.721	1.437	.197	.005	.126	---	---	---
Jan. 1-10, 1946	6,760	---	---	---	---	---	---	---	1.148	.683	.191	.656	1.083	.155	.005	.123	---	---	---
Jan. 11-20	4,257	---	---	---	---	---	---	---	1.297	.773	.347	.688	1.416	.197	.005	.111	---	---	---
Jan. 21-31	1,992	---	---	---	---	---	---	---	1.597	1.069	.348	.852	1.791	.226	.005	.140	---	---	---
Feb. 1-10	1,963	---	---	---	---	---	---	---	1.647	1.069	.254	.852	1.686	.282	.005	.145	---	---	---
Feb. 11-20	1,670	---	---	---	---	---	---	---	1.597	.987	.366	.901	1.645	.254	.005	.145	---	---	---
Feb. 21-28	2,003	---	---	---	---	---	---	---	1.697	1.069	.366	1.000	1.728	.254	.005	.145	---	---	---
Mar. 1-10	4,972	---	---	---	---	---	---	---	1.008	.740	.200	.656	1.145	.141	.011	.094	---	---	---
Mar. 11-20	5,035	---	---	---	---	---	---	---	1.049	.724	.260	.820	1.228	.169	.011	.084	---	---	---
Mar. 21-31	5,444	---	---	---	---	---	---	---	1.098	.724	.267	.836	1.228	.141	.011	.103	---	---	---
Apr. 1-10	2,902	---	---	---	---	---	---	---	1.397	.905	.308	.787	1.478	.282	.005	.114	---	---	---
Apr. 11-20	1,542	---	---	---	---	---	---	---	1.597	1.151	.493	1.000	1.853	.254	.005	.129	---	---	---
Apr. 21-30	1,177	---	---	---	---	---	---	---	1.747	1.234	.481	1.049	2.020	.282	.005	.106	---	---	---
May 1-10	913	---	---	---	---	---	---	---	1.796	1.234	.617	1.213	2.020	.338	.011	.068	---	---	---
May 11-20	4,320	---	---	---	---	---	---	---	1.297	.905	.441	.885	1.416	.254	.011	.077	---	---	---
May 21-31	7,527	---	---	---	---	---	---	---	1.048	.691	.240	.459	1.312	.197	.005	.058	---	---	---
June 1-10	13,000	---	---	---	---	---	---	---	1.008	.740	.268	.541	1.270	.169	.011	.037	---	---	---
June 11-20	3,564	---	---	---	---	---	---	---	1.297	.987	.339	.705	1.707	.226	.011	.074	---	---	---
June 21-30	1,879	---	---	---	---	---	---	---	1.747	1.234	.503	.951	2.165	.282	.011	.090	---	---	---
July 1-10	1,422	---	---	---	---	---	---	---	1.647	1.151	.635	.836	2.317	.197	---	.0[illegible]	---	---	---
July 11-20	714	---	---	---	---	---	---	---	1.946	1.480	.580	1.049	2.498	.338	---	.121	---	---	---
July 21-31	4,308	---	---	---	---	---	---	---	1.297	.987	.366	.656	1.666	.296	---	.102	---	---	---
Aug. 1-10	1,046	---	---	---	---	---	---	---	1.896	1.398	.574	.885	2.603	.282	---	.09[illegible]	---	---	---
Aug. 11-20	1,217	---	---	---	---	---	---	---	2.046	1.816	.675	1.016	2.753	.282	---	.0[illegible]	---	---	---
Aug. 21-31	1,331	---	---	---	---	---	---	---	1.647	1.069	.364	.918	1.832	.254	---	.078	---	---	---
Sept. 1-10	845	---	---	---	---	---	---	---	1.946	1.234	.433	1.[illegible]30	2.144	.282	---	.0[illegible]	---	---	---
Sept. 11-20	484	---	---	---	---	---	---	---	2.296	1.645	.694	1.[illegible]28	3.018	.315	---	.095	---	---	---
Sept. 21-30	898	---	---	---	---	---	---	---	1.946	1.398	.668	1.[illegible]36	2.476	.338	---	.121	---	---	---
Average	3,498	---	---	---	---	---	---	---	1.547	1.069	0.413	0.852	1.932	0.240	0.005	0.100	---	---	---

MERCE

ROCEDURE

a State Libra

Susquehanna River at Falls, Pa.

Chemical analyses, in parts per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																			Total	Noncarbonate
Oct. 1-10, 1944	1,712	62	10	7.7	21.3	1.3	0.02	---	29	4.5	8.4	1.8	84	23	10	0.0	0.6	125	91	22
Oct. 11-20	2,977	56	10	7.8	22.4	.6	.01	0.0	29	5.2	8.5	1.9	90	21	10	.0	.8	125	94	20
Oct. 21-31	5,058	46	8	7.4	17.0	1.4	.02	---	23	4.2	5.4	1.8	66	21	5.5	.1	1.0	97	75	20
Nov. 1-10	2,868	47	8	8.3	19.3	1.0	.02	---	26	4.7	7.1	1.7	76	21	9.0	.2	1.0	110	84	22
Nov. 11-20	4,515	41	15	7.7	18.7	1.4	.03	---	25	4.7	6.1	1.8	74	20	7.2	.1	1.1	106	82	21
Nov. 21-30	6,932	36	10	7.3	14.6	2.0	.02	---	19	3.3	4.5	1.1	54	18	4.6	.1	1.4	83	61	17
Dec. 1-10	10,910	32	10	7.1	11.6	3.0	.03	---	15	2.9	3.6	1.3	39	18	3.8	.2	2.8	70	49	17
Dec. 11-20	12,700	34	10	7.2	11.7	3.1	.02	---	15	2.9	3.2	1.3	40	18	3.8	.1	3.2	71	49	17
Dec. 21-31	5,569	33	8	7.4	15.2	2.5	.02	---	20	3.6	4.2	1.2	57	20	5.0	.1	3.4	89	65	18
Jan. 1-10, 1945	17,740	33	8	7.1	12.2	3.7	.03	---	15	2.0	5.1	1.0	38	18	3.1	.1	2.4	72	46	14
Jan. 11-20	8,103	--	7	7.2	14.0	3.8	.03	.0	20	3.7	3.9	1.1	50	20	4.5	.1	3.7	84	65	24
Jan. 21-31	4,879	34	10	7.4	17.6	2.0	.02	---	24	4.2	4.7	1.2	64	20	5.6	.0	3.4	101	77	25
Feb. 1-10	4,579	34	10	7.3	18.2	2.2	.02	---	25	4.4	4.6	1.4	70	20	6.0	.0	2.9	105	80	23
Feb. 11-20	7,292	33	7	7.2	16.2	3.7	.03	---	21	3.7	5.3	1.1	62	18	6.2	.1	2.8	96	68	17
Feb. 21-28	31,720	35	15	7.1	11.1	3.0	.03	.0	14	3.1	3.3	1.1	35	17	3.1	.1	3.4	68	48	19
Mar. 1-10	66,180	36	25	7.0	8.90	4.2	.07	.0	11	2.2	2.2	1.0	24	15	2.2	.1	3.4	58	36	17
Mar. 11-20	52,260	42	18	7.1	9.59	4.4	.10	.0	13	2.5	1.9	.6	31	14	2.2	.2	2.1	60	43	17
Mar. 21-31	50,060	47	12	7.1	10.3	4.8	.09	.0	14	2.4	2.5	.9	38	14	2.4	.1	1.9	63	45	14
Apr. 1-10	23,500	50	12	7.1	12.4	3.5	.01	.0	16	2.8	3.0	1.0	46	17	3.1	.1	2.4	75	51	14
Apr. 11-20	10,620	58	8	7.3	15.0	1.6	.01	---	21	3.8	3.7	1.1	61	17	4.0	.1	1.9	87	68	18
Apr. 21-30	14,460	56	12	7.3	13.3	2.0	.01	.0	18	3.1	3.7	.6	54	16	3.5	.1	1.3	77	58	13
May 1-10	27,260	56	11	7.1	10.9	3.0	.02	.0	14	2.9	3.3	.5	39	16	2.2	.1	1.4	65	47	15
May 11-20	37,470	58	20	7.1	10.4	4.0	.15	.0	14	2.3	2.9	1.0	40	15	1.8	.1	1.0	65	44	12
May 21-31	18,820	62	15	7.2	14.1	2.6	.03	---	19	3.3	2.8	.9	58	15	2.6	.1	1.6	82	61	13
June 1-10	13,760	62	15	7.3	14.3	1.8	.02	---	19	3.5	3.1	.9	59	16	3.2	.1	1.0	82	62	13
June 11-20	15,490	73	14	7.2	13.6	2.1	.02	.0	18	3.1	3.2	1.2	56	14	3.0	.1	1.7	80	58	12
June 21-30	11,290	76	10	7.3	14.8	1.8	.01	.0	20	3.5	4.6	1.2	62	15	3.5	.2	1.9	86	64	14
July 1-10	6,028	76	12	7.3	17.1	1.0	.01	.0	23	4.0	5.2	1.6	74	16	4.5	.1	1.7	97	74	13
July 11-20	6,177	73	9	7.5	18.8	1.8	.01	.0	25	4.3	5.8	1.3	80	18	6.1	.1	1.6	107	80	15
July 21-31	10,880	76	10	7.2	16.2	3.8	.01	.0	22	3.7	4.4	1.2	69	15	4.6	.1	2.0	95	70	14
Aug. 1-10	8,719	73	9	7.4	14.6	3.8	.02	.0	20	3.3	3.7	1.0	62	14	3.5	.1	.9	86	63	13
Aug. 11-20	4,375	76	10	7.8	18.5	1.3	.02	.0	25	4.4	5.0	1.4	82	17	5.2	.1	.8	103	80	13
Aug. 21-31	3,400	73	7	7.2	20.2	2.2	.01	.0	26	4.9	6.3	1.7	90	16	6.5	.1	.8	113	85	11
Sept. 1-10	4,252	76	5	7.4	21.7	2.1	.01	.0	28	5.2	7.2	1.6	94	18	7.8	.1	1.0	122	91	14
Sept. 11-20	8,872	68	12	6.9	16.7	3.5	.03	.0	22	3.5	5.0	1.4	70	15	5.6	.1	1.7	96	69	12
Sept. 21-30	15,400	63	--	7.2	13.0	4.8	.05	.0	18	3.0	2.6	1.4	52	14	3.0	.1	1.8	73	57	15
Average	14,810	54	11	7.3	15.2	2.6	0.03	0.0	20	3.6	4.4	1.2	59	17	4.7	0.1	1.9	88	65	16

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Susquehanna River at Falls, Pa.

Chemical analyses, in equivalents per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10^6 at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																			Total	Non-carbonate
Oct. 1-10, 1944	1,712	---	---	---	---	---	---	---	1.448	0.370	0.365	0.046	1.377	0.479	0.282	0.000	0.010	---	---	---
Oct. 11-20	2,977	---	---	---	---	---	---	---	1.448	.428	.370	.049	1.475	.437	.282	.000	.013	---	---	---
Oct. 21-31	5,058	---	---	---	---	---	---	---	1.148	.345	.235	.046	1.082	.437	.155	.005	.016	---	---	---
Nov. 1-10	2,868	---	---	---	---	---	---	---	1.298	.387	.309	.043	1.246	.437	.254	.011	.016	---	---	---
Nov. 11-20	4,515	---	---	---	---	---	---	---	1.248	.387	.265	.046	1.213	.416	.203	.005	.018	---	---	---
Nov. 21-30	6,932	---	---	---	---	---	---	---	.948	.271	.196	.028	.885	.375	.130	.005	.023	---	---	---
Dec. 1-10	10,910	---	---	---	---	---	---	---	.749	.238	.157	.033	.639	.375	.107	.011	.045	---	---	---
Dec. 11-20	12,700	---	---	---	---	---	---	---	.749	.238	.139	.033	.656	.375	.107	.005	.052	---	---	---
Dec. 21-31	5,569	---	---	---	---	---	---	---	.998	.296	.183	.031	.934	.416	.141	.005	.055	---	---	---
Jan. 1-10, 1945	17,740	---	---	---	---	---	---	---	.749	.164	.222	.026	.623	.375	.087	.005	.039	---	---	---
Jan. 11-20	8,103	---	---	---	---	---	---	---	.998	.304	.170	.028	.820	.416	.127	.005	.060	---	---	---
Jan. 21-31	4,879	---	---	---	---	---	---	---	1.198	.345	.204	.031	1.049	.416	.158	.000	.055	---	---	---
Feb. 1-10	4,579	---	---	---	---	---	---	---	1.248	.362	.200	.036	1.147	.416	.169	.000	.047	---	---	---
Feb. 11-20	7,292	---	---	---	---	---	---	---	1.048	.304	.230	.028	1.016	.375	.175	.005	.045	---	---	---
Feb. 21-28	31,720	---	---	---	---	---	---	---	.699	.255	.144	.028	.574	.354	.087	.005	.055	---	---	---
Mar. 1-10	66,180	---	---	---	---	---	---	---	.549	.181	.096	.026	.393	.312	.062	.005	.055	---	---	---
Mar. 11-20	52,260	---	---	---	---	---	---	---	.649	.206	.083	.015	.508	.292	.062	.011	.034	---	---	---
Mar. 21-31	50,060	---	---	---	---	---	---	---	.699	.197	.109	.023	.623	.292	.068	.005	.031	---	---	---
Apr. 1-10	23,500	---	---	---	---	---	---	---	.799	.230	.130	.026	.754	.354	.087	.005	.039	---	---	---
Apr. 11-20	10,620	---	---	---	---	---	---	---	1.048	.313	.161	.028	1.000	.354	.113	.005	.031	---	---	---
Apr. 21-30	14,460	---	---	---	---	---	---	---	.898	.255	.161	.015	.885	.333	.099	.005	.021	---	---	---
May 1-10	27,260	---	---	---	---	---	---	---	.699	.238	.144	.013	.639	.333	.062	.005	.023	---	---	---
May 11-20	37,470	---	---	---	---	---	---	---	.699	.189	.126	.026	.656	.312	.051	.005	.016	---	---	---
May 21-31	18,820	---	---	---	---	---	---	---	.948	.271	.122	.023	.951	.312	.073	.005	.026	---	---	---
June 1-10	13,760	---	---	---	---	---	---	---	.948	.288	.135	.023	.967	.333	.090	.005	.016	---	---	---
June 11-20	15,490	---	---	---	---	---	---	---	.898	.255	.139	.031	.918	.291	.085	.005	.027	---	---	---
June 21-30	11,290	---	---	---	---	---	---	---	.998	.288	.200	.031	1.016	.312	.099	.011	.031	---	---	---
July 1-10	6,028	---	---	---	---	---	---	---	1.148	.329	.226	.041	1.213	.333	.127	.005	.027	---	---	---
July 11-20	6,177	---	---	---	---	---	---	---	1.248	.354	.254	.033	1.311	.375	.172	.005	.026	---	---	---
July 21-31	10,880	---	---	---	---	---	---	---	1.098	.304	.191	.031	1.131	.312	.130	.005	.032	---	---	---
Aug. 1-10	8,719	---	---	---	---	---	---	---	.998	.271	.161	.026	1.016	.291	.099	.005	.014	---	---	---
Aug. 11-20	4,375	---	---	---	---	---	---	---	1.248	.362	.217	.036	1.344	.354	.147	.005	.013	---	---	---
Aug. 21-31	3,400	---	---	---	---	---	---	---	1.297	.403	.274	.044	1.475	.333	.183	.005	.013	---	---	---
Sept. 1-10	4,252	---	---	---	---	---	---	---	1.397	.428	.313	.041	1.541	.375	.220	.005	.016	---	---	---
Sept. 11-20	8,872	---	---	---	---	---	---	---	1.098	.288	.217	.036	1.147	.312	.158	.005	.027	---	---	---
Sept. 21-30	15,400	---	---	---	---	---	---	---	.898	.247	.113	.036	.852	.291	.085	.005	.029	---	---	---
Average	14,810	---	---	---	---	---	---	---	0.998	0.296	0.191	0.031	0.967	0.354	0.133	0.005	0.031	---	---	---

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Susquehanna River at Falls, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																	Total	Non-carbonate
Oct. 1-10, 1945	21,740	56	28	7.2	13.0	5.5	0.02	18	3.5	1.5	53	13	2.9	0.1	1.4	79	59	16
Oct. 11-20	18,110	51	20	7.1	13.5	4.6	.03	18	3.1	4.3	56	15	2.8	.1	1.6	79	58	12
Oct. 21-31	11,810	51	15	7.5	15.7	3.5	.03	21	3.6	4.2	64	16	3.8	.1	2.0	89	67	15
Nov. 1-10	19,940	48	16	7.0	12.7	3.5	.02	17	3.1	4.1	52	15	3.2	.1	1.3	75	55	13
Nov. 11-20	21,110	47	4	7.3	12.3	3.1	.02	16	1.6	5.8	46	15	3.0	.1	1.6	70	46	9
Nov. 21-30	31,000	38	14	6.9	10.8	3.9	.06	14	2.8	3.4	38	16	2.8	.1	2.4	66	46	15
Dec. 1-10	25,070	36	10	7.0	12.2	3.9	.03	15	3.1	4.3	43	17	3.1	.1	2.5	72	50	15
Dec. 11-20	13,170	33	6	7.3	15.1	3.8	.03	19	3.8	5.6	58	19	4.0	.1	2.3	87	63	15
Dec. 21-31	9,035	33	10	7.4	17.2	3.1	.03	23	4.2	4.6	67	19	4.9	.0	3.8	100	75	20
Jan. 1-10, 1946	26,280	34	7	7.2	12.7	3.7	.09	16	3.1	3.7	45	16	3.2	.1	2.9	76	53	16
Jan. 11-20	18,870	33	8	7.3	12.7	4.3	.04	16	2.9	4.7	45	16	3.8	.1	3.7	74	52	15
Jan. 21-31	6,481	33	8	7.5	18.4	3.9	.04	24	4.2	7.0	73	20	5.6	.1	4.6	104	77	17
Feb. 1-10	5,256	32	2	7.5	20.1	3.2	.04	26	4.8	7.1	84	19	5.8	.1	3.7	113	85	16
Feb. 11-20	7,432	33	5	7.4	18.0	2.6	.04	24	4.2	6.7	76	17	6.2	.1	3.5	101	77	15
Feb. 21-28	5,376	32	9	7.5	17.1	2.8	.02	22	3.6	6.2	66	17	5.5	.1	4.2	95	70	16
Mar. 1-10	43,300	36	23	6.9	9.94	3.5	.02	12	2.2	3.1	31	13	3.5	.1	2.0	61	39	14
Mar. 11-20	38,760	41	22	7.0	9.58	4.6	.10	13	2.1	2.7	34	13	2.5	.1	2.2	60	41	13
Mar. 21-31	15,140	51	8	7.2	13.7	2.3	.04	18	3.1	4.0	50	17	4.0	.1	2.3	79	58	17
Apr. 1-10	7,910	47	13	7.7	16.7	---	.03	22	3.8	5.2	66	17	6.0	.1	1.5	93	70	16
Apr. 11-20	6,531	50	5	7.4	17.5	.1	.03	22	4.2	7.1	73	17	6.1	.1	1.4	97	72	12
Apr. 21-30	5,273	54	7	7.4	17.7	.4	.02	23	4.0	6.1	72	18	6.1	.1	.6	100	74	15
May 1-10	5,794	56	7	7.7	17.3	.7	.03	23	3.9	6.1	69	19	6.6	.1	1.0	97	73	17
May 11-20	10,380	59	12	7.2	14.4	.8	.01	18	3.3	6.1	57	17	4.6	.1	.8	86	58	12
May 21-31	70,500	63	22	7.0	9.03	3.8	.06	11	2.2	3.6	31	14	1.8	.1	1.9	58	36	11
June 1-10	36,660	60	7	7.4	11.1	4.7	.08	15	2.9	3.2	42	16	2.6	.1	1.7	75	49	15
June 11-20	16,480	69	5	7.3	14.1	3.6	.02	19	3.4	4.5	60	15	3.4	.1	1.8	82	61	12
June 21-30	9,222	74	5	7.5	16.0	2.7	.02	22	3.7	7.2	76	16	4.1	.1	1.0	91	70	8
July 1-10	10,710	77	7	7.5	15.1	1.8	.01	20	5.3	1.9	66	14	4.0	.1	1.7	94	72	18
July 11-20	4,423	--	5	7.6	19.4	1.7	.01	26	4.6	5.5	84	18	4.9	.1	1.2	107	84	15
July 21-31	6,524	78	10	7.4	17.9	2.8	.05	23	4.2	5.4	72	18	5.0	---	2.0	104	75	16
Aug. 1-10	10,030	74	12	7.4	15.9	5.5	.07	20	3.9	5.5	62	18	4.4	---	2.6	95	66	15
Aug. 11-20	6,126	73	10	7.4	16.4	3.0	.05	21	3.9	6.0	68	18	4.2	---	1.4	95	68	13
Aug. 21-31	3,722	70	3	7.6	18.8	1.8	.03	24	4.9	6.4	79	19	6.0	---	1.1	107	80	15
Sept. 1-10	2,136	70	8	7.6	22.9	1.1	.02	30	5.6	9.2	96	25	8.5	.1	1.2	127	98	19
Sept. 11-20	2,125	70	8	7.5	24.0	1.1	.02	32	6.2	8.0	102	23	9.8	.1	1.4	136	105	22
Sept. 21-30	4,346	69	15	7.5	20.9	3.2	.03	29	5.4	3.5	82	21	8.1	.1	1.8	120	95	27
Average		52	10	7.3	15.6	2.9	0.04	20	3.7	5.5	62	17	4.6	0.1	2.1	90	65	14

Susquehanna River at Falls, Pa.

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($Kx10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																	Total	Noncarbonate
Oct. 1-10, 1945	21,740	---	---	---	---	---	---	0.898	0.288	0.064	0.869	0.271	0.082	0.005	0.023	---	---	---
Oct. 11-20	18,110	---	---	---	---	---	---	.898	.255	.187	.918	.312	.079	.005	.026	---	---	---
Oct. 21-31	11,810	---	---	---	---	---	---	1.048	.296	.182	1.049	.333	.107	.005	.032	---	---	---
Nov. 1-10	19,940	---	---	---	---	---	---	.848	.255	.177	.852	.312	.090	.005	.021	---	---	---
Nov. 11-20	21,110	---	---	---	---	---	---	.798	.132	.252	.754	.312	.085	.005	.026	---	---	---
Nov. 21-30	31,000	---	---	---	---	---	---	.699	.230	.150	.623	.333	.079	.005	.039	---	---	---
Dec. 1-10	25,070	---	---	---	---	---	---	.749	.255	.187	.705	.354	.087	.005	.040	---	---	---
Dec. 11-20	13,170	---	---	---	---	---	---	.948	.312	.242	.951	.396	.113	.005	.037	---	---	---
Dec. 21-31	9,035	---	---	---	---	---	---	1.148	.345	.200	1.098	.396	.138	.000	.061	---	---	---
Jan. 1-10, 1946	26,280	---	---	---	---	---	---	.798	.255	.159	.737	.333	.090	.005	.047	---	---	---
Jan. 11-20	18,870	---	---	---	---	---	---	.798	.239	.205	.737	.333	.107	.005	.060	---	---	---
Jan. 21-31	6,481	---	---	---	---	---	---	1.198	.345	.306	1.196	.416	.158	.005	.074	---	---	---
Feb. 1-10	5,256	---	---	---	---	---	---	1.297	.395	.310	1.377	.396	.164	.005	.060	---	---	---
Feb. 11-20	7,432	---	---	---	---	---	---	1.198	.345	.293	1.246	.354	.175	.005	.056	---	---	---
Feb. 21-28	5,376	---	---	---	---	---	---	1.098	.296	.270	1.082	.354	.155	.005	.068	---	---	---
Mar. 1-10	43,300	---	---	---	---	---	---	.599	.181	.135	.508	.271	.099	.005	.032	---	---	---
Mar. 11-20	38,760	---	---	---	---	---	---	.649	.173	.118	.557	.271	.071	.005	.036	---	---	---
Mar. 21-31	15,140	---	---	---	---	---	---	.898	.255	.175	.819	.354	.113	.005	.037	---	---	---
Apr. 1-10	7,910	---	---	---	---	---	---	1.098	.312	.224	1.082	.354	.169	.005	.024	---	---	---
Apr. 11-20	6,531	---	---	---	---	---	---	1.098	.345	.307	1.196	.354	.172	.005	.023	---	---	---
Apr. 21-30	5,273	---	---	---	---	---	---	1.148	.320	.265	1.180	.375	.172	.005	.010	---	---	---
May 1-10	5,794	---	---	---	---	---	---	1.148	.321	.265	1.131	.396	.186	.005	.016	---	---	---
May 11-20	10,380	---	---	---	---	---	---	.898	.271	.267	.934	.354	.130	.005	.013	---	---	---
May 21-31	70,500	---	---	---	---	---	---	.549	.181	.156	.508	.291	.081	.005	.031	---	---	---
June 1-10	36,660	---	---	---	---	---	---	.749	.239	.138	.688	.333	.073	.005	.027	---	---	---
June 11-20	16,480	---	---	---	---	---	---	.948	.280	.197	.983	.312	.096	.005	.029	---	---	---
June 21-30	9,222	---	---	---	---	---	---	1.098	.304	.314	1.246	.333	.116	.005	.011	---	---	---
July 1-10	10,710	---	---	---	---	---	---	.898	.436	.084	1.082	.291	.113	.005	.027	---	---	---
July 11-20	4,423	---	---	---	---	---	---	1.247	.378	.239	1.377	.375	.138	.005	.010	---	---	---
July 21-31	6,524	---	---	---	---	---	---	1.147	.345	.235	1.180	.375	.141	---	.032	---	---	---
Aug. 1-10	10,030	---	---	---	---	---	---	.898	.321	.238	1.016	.375	.124	---	.042	---	---	---
Aug. 11-20	6,126	---	---	---	---	---	---	1.098	.321	.261	1.114	.375	.116	---	.023	---	---	---
Aug. 21-31	3,722	---	---	---	---	---	---	1.198	.403	.277	1.295	.396	.160	---	.011	---	---	---
Sept. 1-10	2,136	---	---	---	---	---	---	1.447	.461	.430	1.573	.521	.240	.005	.010	---	---	---
Sept. 11-20	2,125	---	---	---	---	---	---	1.347	.510	.348	1.672	.479	.275	.005	.023	---	---	---
Sept. 21-30	4,346	---	---	---	---	---	---	1.447	.411	.152	1.644	.437	.209	.005	.009	---	---	---
Average		---	---	---	---	---	---	0.[illegible]	0.304	0.237	1.016	0.354	0.130	0.005	0.034	---	---	---

P 38.42
2.10

MERCE

ROCEDURE

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Susquehanna River at Danville, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($Kx10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																			Total	Noncarbonate
Oct. 1-10, 1945	25,110	54	12	6.8	18.2	5.8	0.04	0.00	22	6.0	2.9	1.8	36	50	2.9	0.1	1.8	111	80	50
Oct. 11-20	22,170	51	8	6.8	18.1	5.2	.03	.00	20	5.8	4.1	2.0	38	45	3.2	.0	1.7	110	74	43
Oct. 21-31	13,120	52	7	7.0	22.8	4.2	.07	.00	26	7.9	5.0	2.1	46	60	3.8	.0	1.8	141	97	60
Nov. 1-10	22,090	47	8	7.0	18.0	3.4	.03	.00	20	5.7	3.9	1.6	39	43	3.0	.1	1.4	104	73	41
Nov. 11-20	23,750	47	7	7.0	16.9	3.0	.04	.00	18	5.2	3.8	1.4	35	41	3.2	.1	1.3	98	66	38
Nov. 21-30	36,790	38	10	7.0	14.4	3.6	.08	.00	16	4.2	3.1	1.5	32	34	2.6	.1	1.5	84	57	31
Dec. 1-10	30,010	32	15	7.0	16.0	3.5	.12	.00	18	4.9	3.5	1.7	34	38	3.0	.1	1.8	94	65	37
Dec. 11-20	16,150	35	2	6.9	16.7	3.8	.02	.00	19	5.9	5.4	1.8	35	46	2.8	.1	2.3	101	72	43
Dec. 21-31	11,300	32	5	6.9	24.8	3.6	.02	.00	28	9.0	7.6	1.6	44	71	4.8	.1	3.7	153	107	71
Jan. 1-10, 1946	30,700	36	8	6.9	17.6	3.8	.06	.00	19	6.1	5.2	1.3	34	45	3.2	.1	3.0	104	73	45
Jan. 11-20	23,890	34	7	6.9	15.1	4.2	.04	.00	17	5.0	4.4	1.2	31	38	2.6	.1	2.9	89	63	38
Jan. 21-31	8,125	31	4	6.9	27.2	4.4	.03	.16	30	10	6.8	1.5	42	80	5.0	.1	4.0	170	116	82
Feb. 1-10	6,173	31	5	7.0	30.2	4.3	.03	.40	34	11	8.2	1.6	52	86	6.1	.1	4.5	190	130	88
Feb. 11-20	8,328	34	2	6.9	27.9	3.4	.05	.00	31	9.8	7.4	1.4	54	74	6.4	.1	4.5	172	118	73
Feb. 21-28	6,173	33	10	7.0	24.2	3.0	.09	.28	26	8.7	5.5	1.7	38	70	5.0	.1	3.8	147	101	70
Mar. 1-10	47,110	38	20	6.8	12.0	3.4	.13	.00	13	3.5	3.0	1.5	25	25	3.4	.1	2.8	74	47	26
Mar. 11-20	50,080	43	25	6.9	11.4	4.8	.22	.00	13	3.5	2.2	1.2	24	26	2.2	.1	2.4	72	47	27
Mar. 21-31	19,100	50	5	6.9	17.1	3.8	.06	.00	19	5.4	3.9	1.6	36	43	3.4	.0	2.6	103	70	40
Apr. 1-10	9,695	50	8	7.0	23.7	1.8	.13	.13	26	8.1	5.5	1.6	43	66	4.6	.1	1.9	145	98	63
Apr. 11-20	7,399	51	5	7.1	26.1	1.2	.06	---	30	9.2	6.2	1.3	45	76	5.4	.1	1.4	159	113	76
Apr. 21-30	5,899	59	7	7.0	27.3	1.6	.04	.00	31	10	4.6	1.1	45	80	6.0	.1	2.3	176	118	82
May 1-10	6,169	58	4	6.9	27.5	4.0	.04	.00	30	9.9	7.1	1.5	49	78	6.5	.2	1.9	176	116	75
May 11-20	11,930	61	8	6.9	20.8	1.2	.02	.03	23	6.8	5.2	.9	40	56	4.5	.1	1.6	127	85	53
May 21-31	88,670	63	10	6.4	11.2	3.6	.09	.02	12	3.8	2.5	.8	22	28	1.8	.1	1.8	68	46	28
June 1-10	46,800	61	18	7.0	14.2	5.1	.10	.03	16	4.4	2.8	.5	31	39	2.4	.1	2.2	86	56	33
June 11-20	18,910	68	10	7.1	19.2	3.4	.06	.03	23	6.5	4.2	.4	42	50	3.1	.1	2.2	116	84	59
June 21-30	11,040	73	3	6.8	23.3	2.3	.02	.00	26	7.8	5.3	.9	46	65	3.5	.1	1.3	142	97	59
July 1-10	12,000	76	14	7.0	23.6	2.8	.03	.00	28	8.4	5.7	.9	42	66	3.9	.1	2.1	144	104	70
July 11-20	5,131	77	8	6.9	31.4	2.8	.02	.00	36	12	6.9	1.4	42	103	5.0	.1	2.0	201	139	105
July 21-31	6,784	77	5	7.1	29.7	3.4	.16	.00	32	11	6.7	2.9	43	96	5.5	.1	3.0	191	125	90
Aug. 1-10	11,440	73	2	6.8	25.1	4.2	.01	.00	26	9.8	5.4	1.8	30	86	4.5	.1	1.8	157	105	81
Aug. 11-20	7,242	73	3	6.7	28.7	4.9	.01	.00	30	12	5.6	1.9	30	103	4.0	.1	2.2	181	124	100
Aug. 21-31	4,576	71	3	6.8	34.1	3.5	.01	.00	35	15	7.0	1.8	27	129	5.5	.1	2.3	220	149	127
Sept. 1-10	2,460	72	2	6.6	47.9	3.7	.01	.53	48	23	9.8	1.8	14	204	6.2	.2	2.2	327	214	203
Sept. 11-20	2,346	71	2	6.6	49.5	3.3	.01	.30	50	24	9.8	2.0	20	208	8.0	.1	2.8	334	223	207
Sept. 21-30	4,463	70	2	6.8	41.4	3.7	.01	.40	41	18	9.9	2.0	33	158	8.0	.1	2.8	270	176	149
Average		53	8	6.9	23.7	3.5	0.06	0.07	26	8.2	5.4	1.5	37	72	4.3	0.1	2.4	148	101	71

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate
Oct. 1-10, 1945	25,110	---	---	---	---	---	---	---	1.008	0.493	0.126	0.046	0.590	1.041	0.082	0.005	0.029	---	---	---
Oct. 11-20	22,170	---	---	---	---	---	---	---	.908	.477	.178	.051	.623	.937	.090	.005	.027	---	---	---
Oct. 21-31	13,120	---	---	---	---	---	---	---	1.297	.650	.217	.054	.754	1.249	.107	.005	.029	---	---	---
Nov. 1-10	22,090	---	---	---	---	---	---	---	.998	.460	.170	.041	.639	.895	.085	.005	.023	---	---	---
Nov. 11-20	23,750	---	---	---	---	---	---	---	.898	.428	.165	.036	.574	.854	.090	.005	.021	---	---	---
Nov. 21-30	36,790	---	---	---	---	---	---	---	.798	.345	.135	.038	.524	.708	.073	.005	.024	---	---	---
Dec. 1-10	30,010	---	---	---	---	---	---	---	.898	.403	.152	.044	.557	.791	.085	.005	.029	---	---	---
Dec. 11-20	16,150	---	---	---	---	---	---	---	.948	.485	.235	.046	.574	.958	.079	.005	.037	---	---	---
Dec. 21-31	11,300	---	---	---	---	---	---	---	1.397	.740	.330	.041	.721	1.478	.135	.005	.060	---	---	---
Jan. 1-10, 1946	30,700	---	---	---	---	---	---	---	.948	.502	.226	.033	.557	.937	.090	.005	.048	---	---	---
Jan. 11-20	23,890	---	---	---	---	---	---	---	.848	.411	.191	.031	.508	.791	.073	.005	.047	---	---	---
Jan. 21-31	8,125	---	---	---	---	---	---	---	1.497	.822	.296	.038	.688	1.666	.141	.005	.065	---	---	---
Feb. 1-10	6,173	---	---	---	---	---	---	---	1.697	.905	.357	.041	.832	1.791	.172	.005	.073	---	---	---
Feb. 11-20	8,328	---	---	---	---	---	---	---	1.547	.806	.322	.036	.885	1.541	.180	.005	.073	---	---	---
Feb. 21-28	6,173	---	---	---	---	---	---	---	1.297	.716	.239	.044	.623	1.457	.141	.005	.061	---	---	---
Mar. 1-10	47,110	---	---	---	---	---	---	---	.649	.288	.130	.038	.410	.521	.096	.005	.045	---	---	---
Mar. 11-20	50,080	---	---	---	---	---	---	---	.649	.288	.096	.031	.393	.541	.082	.005	.039	---	---	---
Mar. 21-31	19,100	---	---	---	---	---	---	---	.948	.444	.170	.041	.590	.895	.096	.000	.042	---	---	---
Apr. 1-10	9,695	---	---	---	---	---	---	---	1.297	.666	.239	.041	.705	1.374	.130	.005	.031	---	---	---
Apr. 11-20	7,399	---	---	---	---	---	---	---	1.497	.757	.270	.033	.737	1.582	.152	.005	.023	---	---	---
Apr. 21-30	5,899	---	---	---	---	---	---	---	1.547	.822	.200	.028	.737	1.666	.169	.005	.037	---	---	---
May 1-10	6,169	---	---	---	---	---	---	---	1.497	.814	.309	.038	.803	1.624	.183	.011	.031	---	---	---
May 11-20	11,930	---	---	---	---	---	---	---	1.148	.559	.226	.023	.656	1.166	.127	.005	.026	---	---	---
May 21-31	88,670	---	---	---	---	---	---	---	.599	.312	.109	.020	.361	.583	.051	.005	.029	---	---	---
June 1-10	46,800	---	---	---	---	---	---	---	.798	.362	.122	.013	.508	.729	.068	.005	.036	---	---	---
June 11-20	18,910	---	---	---	---	---	---	---	1.148	.534	.183	.010	.688	1.041	.087	.005	.036	---	---	---
June 21-30	11,040	---	---	---	---	---	---	---	1.297	.641	.230	.023	.754	1.353	.099	.005	.021	---	---	---
July 1-10	12,000	---	---	---	---	---	---	---	1.397	.691	.248	.023	.688	1.374	.111	.005	.034	---	---	---
July 11-20	5,131	---	---	---	---	---	---	---	1.796	.987	.300	.036	.688	2.144	.141	.005	.032	---	---	---
July 21-31	6,784	---	---	---	---	---	---	---	1.597	.905	.291	.074	.705	1.999	.155	.005	.048	---	---	---
Aug. 1-10	11,440	---	---	---	---	---	---	---	1.297	.806	.235	.046	.492	1.791	.127	.005	.029	---	---	---
Aug. 11-20	7,242	---	---	---	---	---	---	---	1.497	.987	.244	.049	.492	2.144	.113	.005	.035	---	---	---
Aug. 21-31	4,576	---	---	---	---	---	---	---	1.747	1.234	.304	.046	.442	2.686	.155	.005	.037	---	---	---
Sept. 1-10	2,460	---	---	---	---	---	---	---	2.395	1.891	.426	.046	.229	4.247	.175	.011	.035	---	---	---
Sept. 11-20	2,346	---	---	---	---	---	---	---	2.495	1.974	.426	.051	.328	4.331	.226	.005	.045	---	---	---
Sept. 21-30	4,463	---	---	---	---	---	---	---	2.046	1.480	.430	.051	.541	3.290	.226	.005	.045	---	---	---
Average		---	---	---	---	---	---	---	1.297	0.724	0.235	0.038	0.606	1.499	0.121	0.005	0.039	---	---	---

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8.10

MERCE

ROCEDURE

a State Libra

Susquehanna River at Harrisburg, Pa.

East Channel - Station 1180

Chemical analyses, in parts per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																			Total	Non-carbonate
Oct. 1-10, 1944	4,546	61	7	7.0	32.6	2.6	0.01	---	36	11	10	2.4	29	112	10	0.1	1.5	224	135	111
Oct. 11-20	6,366	55	7	7.0	29.3	2.6	.02	0.0	31	9.6	9.7	2.7	26	101	7.8	.1	1.6	185	117	96
Oct. 21-31	14,650	49	6	6.7	22.9	3.8	.02	.0	24	7.1	6.8	2.6	20	75	6.1	.1	2.1	141	89	73
Nov. 1-10	7,207	49	5	7.0	19.9	4.0	.02	.0	21	6.3	6.1	2.3	22	61	5.2	.1	1.8	119	78	60
Nov. 11-20	7,200	45	6	7.2	23.9	2.4	.05	.0	26	7.0	7.2	1.9	33	68	6.5	.1	1.3	143	94	67
Nov. 21-30	12,700	40	5	7.2	21.8	3.4	.04	.0	25	6.8	7.5	2.1	35	63	5.8	.1	2.2	130	90	62
Dec. 1-10	20,110	33	4	7.1	17.3	4.0	.04	.0	20	5.4	5.4	1.4	28	48	4.1	.1	2.6	104	72	49
Dec. 11-20	30,630	33	5	7.0	13.9	4.7	.08	.0	16	4.2	3.9	1.3	22	38	3.5	.1	2.8	85	57	39
Dec. 21-31	14,860	32	5	6.9	20.1	4.5	.04	.0	22	7.2	4.7	1.4	26	62	4.8	.1	3.5	128	84	63
Jan. 1-10, 1945	42,070	32	3	6.7	18.6	4.4	.02	---	19	6.9	6.0	1.2	19	60	3.4	.1	3.1	117	76	60
Jan. 11-20	19,040	32	5	6.8	22.9	4.1	.02	---	23	9.3	4.1	1.5	17	79	4.2	.0	2.7	146	96	82
Jan. 21-31	12,700	32	10	7.1	20.4	3.6	.04	---	22	6.3	6.3	1.4	34	54	5.2	.0	3.4	126	81	53
Feb. 1-10	12,120	32	8	7.1	22.0	4.4	.06	.1	24	7.1	9.7	1.0	44	60	5.6	.1	3.4	134	89	53
Feb. 11-20	23,550	32	17	6.9	19.4	5.4	.16	---	22	5.5	7.5	1.0	43	47	5.0	.2	4.3	122	78	42
Feb. 21-28	81,120	33	5	6.8	14.2	5.2	.03	---	15	4.1	4.4	1.1	20	38	3.2	.1	3.7	89	54	38
Mar. 1-10	186,800	36	12	6.3	8.97	4.2	.10	.0	10	2.7	2.0	.5	8	26	1.8	.2	2.6	58	36	30
Mar. 11-20	116,200	43	7	6.6	9.77	4.7	.05	.0	11	3.1	2.7	.5	12	28	2.1	.1	2.0	62	40	30
Mar. 21-31	123,200	49	11	6.7	9.58	4.4	.08	.0	11	2.9	2.2	.6	18	24	1.9	.1	1.9	61	39	25
Apr. 1-10	67,350	53	6	6.7	11.6	4.8	.04	.0	13	3.4	3.0	.9	19	32	2.1	.1	1.6	70	46	31
Apr. 11-20	36,060	59	7	6.8	11.7	3.4	.01	.0	12	3.6	2.6	1.1	11	36	2.5	.1	1.9	70	45	31
Apr. 21-30	43,540	52	3	6.6	12.2	4.4	.03	.1	13	4.1	2.4	.8	10	40	2.2	.1	.8	76	49	41
May 1-10	75,930	51	8	6.8	9.42	4.6	.04	.0	10	2.9	2.3	.9	16	25	1.5	.1	1.4	57	37	24
May 11-20	101,000	56	12	6.8	9.40	4.2	.07	.0	10	2.9	2.2	.7	16	25	2.1	.1	1.2	58	37	24
May 21-31	60,410	60	8	6.8	10.6	4.5	.05	---	12	3.4	2.1	.8	17	29	1.8	.1	1.6	66	44	30
June 1-10	43,690	58	8	6.7	10.3	4.3	.04	---	11	3.1	1.9	.8	14	29	2.0	.1	1.3	63	40	29
June 11-20	29,120	72	8	7.0	14.4	3.1	.01	.0	16	4.5	3.2	1.0	26	39	3.0	.1	1.1	88	58	37
June 21-30	25,410	74	8	7.1	16.6	4.0	.03	.0	19	5.2	3.7	1.4	32	44	3.0	.1	1.8	104	69	43
July 1-10	14,570	75	8	6.9	18.6	4.6	.03	.0	21	6.2	5.4		28	53	4.0	.1	2.1	113	78	55
July 11-20	13,240	71	6	7.0	21.7	3.8	.03	.0	23	7.7	6.0		28	68	4.5	.1	1.6	134	89	66
July 21-31	24,280	74	4	6.8	25.3	3.6	.02	.3	25	9.6	6.1	1.6	12	91	4.5	.1	2.0	162	102	92
Aug. 1-10	24,070	72	5	6.9	18.2	5.4	.02	.0	18	5.9	4.4	1.2	17	59	3.5	.1	1.9	113	69	55
Aug. 11-20	10,790	73	5	6.8	21.3	4.0	.02	.0	22	7.8	4.7	1.4	22	72	4.1	.1	1.5	134	87	69
Aug. 21-31	10,880	70	5	7.0	23.1	2.4	.03	.0	24	9.0	5.4	2.1	25	77	4.5	.1	1.7	143	97	76
Sept. 1-10	9,279	73	2	6.7	27.1	3.8	.01	.0	26	12	6.4	1.9	20	98	5.0	.1	1.9	178	114	98
Sept. 11-20	22,980	67	8	6.7	26.3	4.8	.02	.0	27	9.7	6.7	1.7	22	89	5.5	.1	2.9	164	107	89
Sept. 21-30	44,570	64	--	6.8	14.5	5.2	.03	.0	16	4.4	3.2	1.5	16	45	2.8	.1	2.0	89	58	45
Average	38,410	53	7	6.9	18.1	4.1	0.04	0.0	19	6.1	4.9	1.4	22	55	4.0	0.1	2.1	113	72	54

Susquehanna River at Harrisburg, Pa.
East Channel - Station 1180
Chemical analyses, in equivalents per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate
Oct. 1-10, 1944	4,546	---	---	---	---	---	---	---	1.797	0.905	0.435	0.061	0.475	2.332	0.282	0.005	0.024	---	---	---
Oct. 11-20	6,366	---	---	---	---	---	---	---	1.547	.789	.422	.069	.426	2.103	.220	.005	.026	---	---	---
Oct. 21-31	14,650	---	---	---	---	---	---	---	1.198	.584	.296	.066	.328	1.562	.172	.005	.034	---	---	---
Nov. 1-10	7,207	---	---	---	---	---	---	---	1.048	.518	.265	.059	.361	1.270	.147	.005	.029	---	---	---
Nov. 11-20	7,200	---	---	---	---	---	---	---	1.298	.576	.313	.049	.541	1.416	.183	.005	.021	---	---	---
Nov. 21-30	12,700	---	---	---	---	---	---	---	1.248	.559	.326	.054	.574	1.312	.164	.005	.035	---	---	---
Dec. 1-10	20,110	---	---	---	---	---	---	---	.998	.444	.235	.036	.459	.999	.116	.005	.042	---	---	---
Dec. 11-20	30,630	---	---	---	---	---	---	---	.799	.345	.170	.033	.361	.791	.099	.005	.045	---	---	---
Dec. 21-31	14,860	---	---	---	---	---	---	---	1.098	.592	.204	.036	.426	1.291	.135	.005	.056	---	---	---
Jan. 1-10, 1945	42,070	---	---	---	---	---	---	---	.948	.567	.261	.031	.311	1.249	.096	.005	.050	---	---	---
Jan. 11-20	19,040	---	---	---	---	---	---	---	1.148	.765	.178	.038	.279	1.645	.118	.000	.044	---	---	---
Jan. 21-31	12,700	---	---	---	---	---	---	---	1.098	.518	.274	.036	.557	1.124	.147	.000	.055	---	---	---
Feb. 1-10	12,120	---	---	---	---	---	---	---	1.198	.584	.422	.026	.721	1.249	.158	.005	.055	---	---	---
Feb. 11-20	23,550	---	---	---	---	---	---	---	1.098	.482	.326	.026	.705	.978	.141	.011	.069	---	---	---
Feb. 21-28	81,120	---	---	---	---	---	---	---	.749	.337	.191	.028	.328	.791	.090	.005	.060	---	---	---
Mar. 1-10	186,800	---	---	---	---	---	---	---	.499	.222	.087	.013	.131	.541	.051	.011	.042	---	---	---
Mar. 11-20	116,200	---	---	---	---	---	---	---	.549	.255	.117	.013	.197	.583	.059	.005	.032	---	---	---
Mar. 21-31	123,200	---	---	---	---	---	---	---	.549	.238	.096	.015	.295	.500	.054	.005	.031	---	---	---
Apr. 1-10	67,350	---	---	---	---	---	---	---	.649	.280	.130	.023	.311	.666	.059	.005	.026	---	---	---
Apr. 11-20	36,060	---	---	---	---	---	---	---	.599	.296	.113	.028	.180	.750	.071	.005	.031	---	---	---
Apr. 21-30	43,540	---	---	---	---	---	---	---	.649	.337	.104	.020	.164	.833	.062	.005	.013	---	---	---
May 1-10	75,930	---	---	---	---	---	---	---	.499	.238	.100	.023	.262	.520	.042	.005	.023	---	---	---
May 11-20	101,000	---	---	---	---	---	---	---	.499	.238	.096	.018	.262	.520	.059	.005	.019	---	---	---
May 21-31	60,410	---	---	---	---	---	---	---	.599	.280	.091	.020	.279	.604	.051	.005	.026	---	---	---
June 1-10	43,690	---	---	---	---	---	---	---	.549	.255	.083	.020	.229	.604	.056	.005	.021	---	---	---
June 11-20	29,120	---	---	---	---	---	---	---	.798	.370	.139	.020	.426	.812	.065	.005	.018	---	---	---
June 21-30	25,410	---	---	---	---	---	---	---	.948	.428	.161	.030	.624	.916	.085	.005	.029	---	---	---
July 1-10	14,570	---	---	---	---	---	---	---	1.048	.510	.235		.459	1.103	.113	.005	.034	---	---	---
July 11-20	13,240	---	---	---	---	---	---	---	1.148	.633	.261		.459	1.416	.127	.005	.026	---	---	---
July 21-31	24,280	---	---	---	---	---	---	---	1.248	.780	.265	.041	.197	1.895	.127	.005	.032	---	---	---
Aug. 1-10	24,070	---	---	---	---	---	---	---	.998	.485	.191	.031	.279	1.228	.099	.005	.031	---	---	---
Aug. 11-20	10,790	---	---	---	---	---	---	---	1.098	.641	.204	.036	.361	1.499	.116	.005	.024	---	---	---
Aug. 21-31	10,880	---	---	---	---	---	---	---	1.198	.740	.235	.054	.410	1.603	.127	.005	.027	---	---	---
Sept. 1-10	9,279	---	---	---	---	---	---	---	1.297	.937	.278	.049	.328	2.040	.141	.005	.031	---	---	---
Sept. 11-20	22,980	---	---	---	---	---	---	---	1.347	.798	.291	.044	.361	1.853	.155	.005	.047	---	---	---
Sept. 21-30	44,570	---	---	---	---	---	---	---	.798	.362	.139	.038	.262	.937	.079	.005	.032	---	---	---
Average	38,410	---	---	---	---	---	---	---	0.948	0.502	0.213	0.036	0.361	1.145	0.113	0.005	0.034	---	---	---

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Susquehanna River at Harrisburg, Pa.

East Channel - Station 1180

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																	Total	Noncarbonate
Oct. 1-10, 1945	47,020	57	12	6.7	12.9	5.0	0.06	15	4.3	1.7	22	34	2.6	0.1	1.8	78	55	37
Oct. 11-20	38,980	52	7	6.9	15.0	4.8	.02	17	4.9	3.9	33	37	2.9	.1	1.5	90	63	36
Oct. 21-31	22,530	53	6	7.0	19.1	4.2	.01	21	6.4	4.6	35	51	3.8	.1	1.6	115	79	50
Nov. 1-10	36,580	50	12	7.0	15.9	4.1	.05	17	5.0	5.3	34	39	3.2	.0	2.0	91	63	35
Nov. 11-20	48,110	47	3	6.9	12.4	4.7	.03	13	3.6	3.1	20	31	2.6	.1	1.7	73	47	31
Nov. 21-30	99,120	40	6	6.6	9.91	4.5	.05	11	3.0	3.1	18	25	2.2	.1	1.8	61	40	25
Dec. 1-10	83,940	38	5	6.8	10.2	4.8	.03	11	3.2	2.2	14	28	2.2	.1	1.8	62	41	29
Dec. 11-20	38,900	32	5	7.2	13.1	4.8	.01	14	4.2	3.5	22	34	3.0	.1	2.4	77	52	34
Dec. 21-31	25,450	34	6	7.3	22.5	3.8	.03	24	8.3	5.0	32	67	4.1	.0	3.9	143	94	68
Jan. 1-10, 1946	69,260	34	5	7.1	18.0	3.9	.03	19	6.0	5.2	28	51	3.4	.1	2.8	109	72	49
Jan. 11-20	66,870	35	2	6.8	9.37	4.5	.02	9.5	2.8	3.0	12	26	2.2	.1	1.9	56	35	25
Jan. 21-31	20,360	33	3	7.2	23.0	5.2	.06	25	8.1	6.9	50	57	4.5	.1	4.7	138	96	55
Feb. 1-10	16,650	34	2	6.9	35.7	5.4	.03	36	16	8.4	22	138	5.9	.1	4.4	241	156	138
Feb. 11-20	18,450	34	2	7.0	33.9	3.8	.03	34	14	8.7	26	122	6.8	.1	4.0	219	142	121
Feb. 21-28	19,000	34	2	7.2	18.6	3.2	.05	20	6.0	5.5	34	47	4.8	.1	3.2	111	75	47
Mar. 1-10	98,320	38	8	6.7	11.3	4.3	.04	12	3.3	2.6	14	31	2.8	.1	1.7	68	43	32
Mar. 11-20	114,400	42	5	6.8	8.96	4.1	.08	9.6	2.8	2.8	15	22	3.0	.1	2.2	54	35	23
Mar. 21-31	56,630	49	2	6.8	10.2	4.2	.07	11	3.3	2.2	14	28	2.5	.1	1.7	60	41	30
Apr. 1-10	28,910	49	6	7.2	12.1	4.0	.05	12	3.8	4.2	14	36	3.0	.1	1.5	74	46	34
Apr. 11-20	18,130	51	2	7.0	15.6	3.8	.04	16	5.0	5.1	24	43	4.0	.1	1.6	93	60	41
Apr. 21-30	14,110	55	4	7.2	17.8	3.2	.03	19	5.6	5.8	27	52	4.0	.1	1.1	109	70	48
May 1-10	13,040	57	5	7.2	19.0	1.9	.03	20	6.0	6.6	28	55	5.5	.1	.9	115	75	52
May 11-20	30,900	60	9	6.8	13.4	2.5	.02	14	4.0	4.6	16	41	3.5	.1	.6	84	51	38
May 21-31	184,700	61	18	6.8	8.95	4.8	.40	10	2.6	4.1	19	24	1.8	.1	1.4	66	36	20
June 1-10	114,000	60	7	6.9	10.7	5.1	.11	11	3.2	4.3	19	28	2.4	.1	1.9	66	41	25
June 11-20	56,940	66	2	6.8	11.7	5.4	.03	12	3.5	4.9	17	35	2.2	.1	1.6	73	44	30
June 21-30	34,380	69	5	6.8	13.7	4.9	.02	14	4.4	4.3	12	45	3.0	.1	1.4	84	53	43
July 1-10	26,980	75	3	6.8	16.0	4.0	.01	17	3.6	6.9	16	51	3.0	.1	1.9	114	57	44
July 11-20	12,670	75	3	7.1	18.8	4.1	.01	20	6.2	4.5	22	58	3.6	.1	1.8	114	75	57
July 21-31	14,170	75	5	7.0	23.3	3.6	.04	25	7.8	7.7	31	74	5.0	---	2.0	147	94	69
Aug. 1-10	21,980	73	3	6.9	20.2	4.0	.04	22	6.6	5.8	26	63	4.2	---	2.3	128	82	61
Aug. 11-20	14,790	71	6	7.0	19.4	4.6	.04	20	6.3	6.2	24	60	3.9	---	1.9	121	76	56
Aug. 21-31	11,200	69	6	7.2	21.6	4.4	.04	22	7.1	7.1	24	70	4.2	---	1.4	133	84	64
Sept. 1-10	5,772	68	8	7.3	24.2	1.8	.02	24	8.8	8.3	33	75	5.5	---	1.4	150	96	69
Sept. 11-20	5,431	66	8	7.4	29.7	1.4	.02	31	11	9.8	42	94	7.2	---	1.9	185	123	88
Sept. 21-30	9,701	68	10	7.5	26.9	1.6	.03	29	9.6	9.7	50	77	7.5	---	1.5	168	112	71
Average	42,960	53	6	7.0	17.3	4.0	0.05	18	5.8	5.5	25	51	3.8	0.1	2.0	108	69	48

Susquehanna River at Harrisburg, Pa.

East Channel - Station 1140

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10^6 at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																	Total	Non-carbonate
Oct. 1-10, 1945	47,020	---	---	---	---	---	---	0.749	0.354	0.073	0.301	0.708	0.073	0.005	0.029	---	---	---
Oct. 11-20	38,[illegible]0	---	---	---	---	---	---	.848	.403	.171	.541	.770	.082	.005	.024	---	---	---
Oct. 21-31	22,530	---	---	---	---	---	---	1.048	.526	.200	.574	1.062	.107	.005	.025	---	---	---
Nov. 1-10	36,980	---	---	---	---	---	---	.848	.411	.232	.557	.812	.090	.000	.032	---	---	---
Nov. 11-20	48,110	---	---	---	---	---	---	.649	.296	.133	.328	.645	.073	.005	.027	---	---	---
Nov. 21-30	99,120	---	---	---	---	---	---	.549	.247	.136	.295	.541	.062	.005	.029	---	---	---
Dec. 1-10	66,940	---	---	---	---	---	---	.549	.263	.096	.329	.583	.062	.005	.029	---	---	---
Dec. 11-20	36,900	---	---	---	---	---	---	.699	.345	.154	.361	.708	.085	.005	.039	---	---	---
Dec. 21-31	25,450	---	---	---	---	---	---	1.198	.683	.217	.524	1.395	.116	.000	.003	---	---	---
Jan. 1-10, 1946	69,260	---	---	---	---	---	---	.948	.493	.226	.459	1.062	.096	.005	.045	---	---	---
Jan. 11-20	66,870	---	---	---	---	---	---	.474	.230	.132	.197	.541	.062	.005	.031	---	---	---
Jan. 21-31	20,360	---	---	---	---	---	---	1.248	.666	.300	.819	1.187	.127	.005	.076	---	---	---
Feb. 1-10	16,650	---	---	---	---	---	---	1.796	1.316	.364	.361	2.873	.166	.005	.071	---	---	---
Feb. 11-20	18,450	---	---	---	---	---	---	1.697	1.151	.380	.426	2.540	.192	.005	.065	---	---	---
Feb. 21-28	19,000	---	---	---	---	---	---	.998	.493	.237	.557	.979	.135	.005	.052	---	---	---
Mar. 1-10	98,320	---	---	---	---	---	---	.599	.271	.115	.229	.645	.079	.005	.027	---	---	---
Mar. 11-20	114,400	---	---	---	---	---	---	.479	.230	.121	.246	.458	.085	.005	.036	---	---	---
Mar. 21-31	56,630	---	---	---	---	---	---	.549	.271	.095	.229	.583	.071	.005	.027	---	---	---
Apr. 1-10	28,910	---	---	---	---	---	---	.599	.312	.182	.229	.750	.085	.005	.024	---	---	---
Apr. 11-20	18,130	---	---	---	---	---	---	.798	.411	.223	.393	.895	.113	.005	.026	---	---	---
Apr. 21-30	14,110	---	---	---	---	---	---	.948	.461	.252	.442	1.083	.113	.005	.018	---	---	---
May 1-10	13,040	---	---	---	---	---	---	.998	.493	.288	.459	1.145	.155	.005	.015	---	---	---
May 11-20	30,900	---	---	---	---	---	---	.699	.329	.202	.262	.854	.099	.005	.010	---	---	---
May 21-31	184,700	---	---	---	---	---	---	.499	.214	.177	.311	.500	.051	.005	.023	---	---	---
June 1-10	114,000	---	---	---	---	---	---	.549	.263	.186	.311	.583	.066	.005	.031	---	---	---
June 11-20	56,040	---	---	---	---	---	---	.599	.288	.214	.279	.729	.062	.005	.026	---	---	---
June 21-30	34,380	---	---	---	---	---	---	.699	.362	.186	.197	.937	.085	.005	.023	---	---	---
July 1-10	26,980	---	---	---	---	---	---	.848	.296	.301	.262	1.062	.085	.005	.031	---	---	---
July 11-20	12,670	---	---	---	---	---	---	.998	.510	.197	.361	1.208	.102	.005	.029	---	---	---
July 21-31	14,170	---	---	---	---	---	---	1.248	.641	.333	.508	1.541	.141	---	.032	---	---	---
Aug. 1-10	21,980	---	---	---	---	---	---	1.098	.543	.252	.426	1.312	.118	---	.037	---	---	---
Aug. 11-20	14,790	---	---	---	---	---	---	.998	.518	.268	.393	1.249	.111	---	.031	---	---	---
Aug. 21-31	11,200	---	---	---	---	---	---	1.098	.584	.309	.393	1.457	.118	---	.023	---	---	---
Sept. 1-10	5,772	---	---	---	---	---	---	1.198	.724	.359	.541	1.562	.155	---	.023	---	---	---
Sept. 11-20	5,431	---	---	---	---	---	---	1.547	.905	.427	.688	1.957	.203	---	.031	---	---	---
Sept. 21-30	9,701	---	---	---	---	---	---	1.447	.790	.421	.819	1.603	.212	---	.024	---	---	---
Average	42,960	---	---	---	---	---	---	0.898	0.477	0.241	0.410	1.062	0.107	0.005	0.032	---	---	---

G8.49
8.1.0
MERCE
ROCEDURE
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West Branch Susquehanna River at Lock Haven, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$		Total acidity as H_2SO_4
																				Total	Noncarbonate	
Oct. 1-10, 1945	10,080	54	4	4.6	11.5	4.6	0.7	0.04	0.20	8.6	3.7	1.8	2.0	2	39	1.4	0.1	0.8	67	41	39	10
Oct. 11-20	4,115	49	2	4.25	16.1	4.8	1.3	.03	.25	11	4.3	2.3	1.6	0	52	1.6	.1	.6	85	55	55	17
Oct. 21-31	3,403	49	2	4.10	20.3	5.3	1.7	.05	.25	13	5.0	3.2	1.7	0	67	2.4	.1	.4	105	67	67	20
Nov. 1-10	8,142	45	2	4.40	13.2	4.5	.8	.05	.10	9.4	3.8	2.6	1.2	0	44	2.1	.1	.4	73	45	45	12
Nov. 11-20	10,040	45	3	4.5	11.5	4.4	.7	.06	.20	7.8	3.5	1.8	1.5	1	38	1.8	.1	.6	64	38	37	12
Nov. 21-30	14,900	38	2	4.30	10.6	4.7	.7	.02	.15	7.1	2.8	1.8	1.4	0	34	1.6	.1	.9	59	35	35	14
Dec. 1-10	10,770	38	2	4.05	12.8	5.0	.8	.18	.13	7.9	3.1	2.2	1.1	0	39	2.0	.1	.9	66	42	42	19
Dec. 11-20	4,722	32	2	3.90	17.0	5.3	1.3	.03	.18	9.8	3.8	2.5	1.2	0	53	2.2	.1	.8	88	54	54	32
Dec. 21-31	3,044	32	3	3.70	24.9	5.8	2.2	.07	.35	14	5.5	3.9	1.5	0	79	2.6	.1	.9	120	81	81	32
Jan. 1-10, 1946	10,490	34	3	3.90	20.3	5.3	1.7	.07	.35	13	5.1	3.5	1.2	0	67	2.4	.1	1.0	106	70	70	24
Jan. 11-20	10,460	34	2	4.30	11.3	3.3	.8	.04	.10	8.1	3.0	2.3	1.2	0	36	.8	.1	1.2	61	39	39	14
Jan. 21-31	2,612	32	4	3.90	21.2	5.0	1.8	.06	.30	13	5.0	3.5	1.4	0	71	1.2	.1	1.3	106	70	70	24
Feb. 1-10	1,907	32	5	3.80	28.1	5.6	2.5	.08	.30	18	6.5	4.7	1.5	0	99	3.1	.1	1.2	143	94	94	30
Feb. 11-20	2,094	32	8	3.80	27.4	4.4	2.1	.05	.43	18	6.6	8.5	1.7	0	95	3.6	.1	1.0	142	93	93	32
Feb. 21-28	5,074	32	10	4.00	20.2	4.6	1.5	.06	.31	13	4.6	3.5	1.6	0	67	2.9	.1	1.0	103	66	66	13
Mar. 1-10	17,470	37	10	4.5	9.00	3.9	.5	.04	.16	6.7	2.3	1.1	2.0	0	30	1.6	.1	1.0	51	29	29	11
Mar. 11-20	15,770	43	18	4.5	9.38	4.3	.6	.04	.13	6.7	2.4	1.4	1.0	0	31	1.6	.1	.9	53	30	30	11
Mar. 21-31	7,362	47	8	4.20	13.7	4.7	.7	.03	.12	8.7	3.2	1.9	.8	0	43	1.0	.1	.8	70	42	42	12
Apr. 1-10	3,983	47	7	4.00	16.5	5.1	.7	.06	.12	11	3.8	2.2	.6	0	53	1.6	.1	.4	84	52	52	16
Apr. 11-20	2,413	50	5	3.90	21.4	5.2	.8	.10	.14	13	4.6	3.4	.6	0	70	1.2	.1	.6	107	62	62	20
Apr. 21-30	1,979	56	2	3.90	23.6	5.0	1.6	.04	.35	17	5.3	3.9	1.2	0	79	3.0	.1	.6	122	80	80	25
May 1-10	2,742	54	3	3.90	24.4	4.6	1.7	.12	.35	17	5.5	4.5	.9	0	82	3.5	.1	.4	126	82	82	25
May 11-20	6,504	56	2	4.5	11.6	3.8	.7	.02	.15	9.4	3.0	2.4	.7	0	39	1.9	.1	.4	66	40	40	10
May 21-31	18,730	59	6	4.7	9.50	4.7	.6	.02	.15	7.1	2.5	1.7	.4	1	31	1.8	.1	.6	55	32	31	---
June 1-10	14,060	57	1	4.20	12.5	5.2	.9	.02	.24	8.2	3.1	1.8	1.0	0	40	1.5	.1	1.0	67	42	42	14
June 11-20	14,700	62	2	4.20	13.8	5.2	1.0	.03	.28	9.4	3.4	2.1	1.1	0	45	1.5	.1	1.1	74	47	47	14
June 21-30	8,465	66	1	3.90	20.3	5.9	1.6	.04	.24	12	4.6	2.6	1.1	0	64	1.4	.1	.9	101	64	64	22
July 1-10	5,659	72	3	3.90	21.1	5.9	1.8	.04	.35	12	4.8	2.0	1.7	0	70	1.8	.1	1.0	105	67	67	26
July 11-20	1,575	74	5	3.50	37.1	6.8	3.5	.20	.60	21	8.2	4.0	2.2	0	124	3.6	.1	1.0	189	124	124	47
July 21-31	1,869	74	3	3.60	39.1	6.0	3.5	.28	.50	24	8.9	5.6	2.6	0	137	2.8	.2	1.0	199	130	130	46
Aug. 1-10	2,628	70	5	3.70	29.1	4.8	2.6	.16	.31	20	7.4	1.9		0	101	2.6	.1	1.4	150	106	106	33
Aug. 11-20	1,934	70	2	3.80	25.6	4.2	1.8	.06	.40	17	6.1	3.5	2.3	0	88	2.8	.1	1.0	134	87	87	28
Aug. 21-31	1,410	65	2	3.80	27.6	6.3	2.1	.10	.47	19	6.7	4.2	1.6	0	96	2.9	.1	1.1	149	96	96	28
Sept. 1-10	577	65	2	3.55	40.7	6.8	4.1	.22	.80	26	9.7	6.3	2.1	0	142	3.8	.2	1.6	210	144	144	48
Sept. 11-20	623	64	2	3.50	48.3	7.2	4.9	.23	.80	31	12	7.4	2.4	0	173	5.0	.2	1.2	250	172	172	60
Sept. 21-30	931	66	2	3.45	50.3	6.8	4.9	.32	.80	32	12	7.9	2.2	0	179	5.0	.2	.9	262	177	177	60
Average	6,416	51	4	4.00	21.4	5.1	1.7	0.08	0.31	14	5.2	3.3	1.4	0	72	2.3	0.1	0.9	111	72	72	25

West Branch Susquehanna River at Lock Haven, Pa.

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
Oct. 1-10, 1945	10,080	---	---	---	---	---	0.078	0.002	0.007	0.429	0.304	0.078	0.051	0.033	0.812	0.040	0.005	0.013	---	---	---	---
Oct. 11-20	4,115	---	---	---	---	---	.145	.002	.009	.549	.354	.100	.041	.000	1.083	.045	.005	.010	---	---	---	---
Oct. 21-31	3,403	---	---	---	---	---	.189	.003	.009	.649	.411	.139	.044	.000	1.395	.068	.005	.007	---	---	---	---
Nov. 1-10	6,142	---	---	---	---	---	.089	.003	.004	.469	.313	.113	.031	.000	.916	.059	.005	.007	---	---	---	---
Nov. 11-20	10,040	---	---	---	---	---	.078	.003	.007	.389	.288	.078	.038	.016	.791	.051	.005	.010	---	---	---	---
Nov. 21-30	14,900	---	---	---	---	---	.078	.001	.005	.354	.230	.078	.036	.000	.708	.045	.005	.015	---	---	---	---
Dec. 1-10	10,770	---	---	---	---	---	.089	.010	.005	.394	.255	.096	.028	.000	.812	.056	.005	.015	---	---	---	---
Dec. 11-20	4,722	---	---	---	---	---	.145	.002	.007	.489	.313	.109	.031	.000	1.103	.062	.005	.013	---	---	---	---
Dec. 21-31	3,044	---	---	---	---	---	.245	.004	.013	.699	.452	.170	.038	.000	1.645	.073	.005	.015	---	---	---	---
Jan. 1-10, 1946	10,490	---	---	---	---	---	.189	.004	.013	.649	.419	.152	.031	.000	1.395	.068	.005	.016	---	---	---	---
Jan. 11-20	10,460	---	---	---	---	---	.089	.002	.004	.404	.247	.100	.031	.000	.750	.023	.005	.019	---	---	---	---
Jan. 21-31	2,612	---	---	---	---	---	.200	.003	.011	.649	.411	.152	.036	.000	1.478	.034	.005	.021	---	---	---	---
Feb. 1-10	1,907	---	---	---	---	---	.278	.004	.011	.898	.534	.204	.038	.000	2.061	.087	.005	.019	---	---	---	---
Feb. 11-20	2,094	---	---	---	---	---	.234	.003	.016	.898	.543	.370	.044	.000	1.978	.102	.005	.016	---	---	---	---
Feb. 21-28	5,074	---	---	---	---	---	.167	.003	.011	.649	.378	.152	.041	.000	1.395	.082	.005	.016	---	---	---	---
Mar. 1-10	17,470	---	---	---	---	---	.056	.002	.006	.334	.189	.048	.051	.000	.625	.045	.005	.016	---	---	---	---
Mar. 11-20	15,770	---	---	---	---	---	.067	.002	.005	.334	.197	.061	.026	.000	.645	.045	.005	.014	---	---	---	---
Mar. 21-31	7,362	---	---	---	---	---	.078	.002	.004	.434	.263	.083	.020	.000	.895	.028	.005	.013	---	---	---	---
Apr. 1-10	3,983	---	---	---	---	---	.078	.003	.004	.549	.312	.096	.015	.000	1.103	.045	.005	.006	---	---	---	---
Apr. 11-20	2,413	---	---	---	---	---	.089	.005	.005	.649	.378	.148	.015	.000	1.457	.034	.005	.010	---	---	---	---
Apr. 21-30	1,979	---	---	---	---	---	.178	.002	.013	.848	.436	.170	.031	.000	1.645	.085	.005	.010	---	---	---	---
May 1-10	2,742	---	---	---	---	---	.189	.006	.013	.848	.452	.196	.023	.000	1.707	.099	.005	.006	---	---	---	---
May 11-20	6,504	---	---	---	---	---	.078	.001	.005	.469	.247	.104	.013	.000	.812	.054	.005	.006	---	---	---	---
May 21-31	18,730	---	---	---	---	---	.067	.001	.005	.354	.206	.074	.010	.016	.645	.051	.005	.010	---	---	---	---
June 1-10	14,060	---	---	---	---	---	.100	.001	.009	.409	.255	.078	.026	.000	.833	.042	.005	.016	---	---	---	---
June 11-20	14,700	---	---	---	---	---	.111	.002	.010	.469	.280	.091	.028	.000	.937	.042	.005	.018	---	---	---	---
June 21-30	8,465	---	---	---	---	---	.178	.002	.009	.599	.378	.113	.029	.000	1.322	.039	.005	.014	---	---	---	---
July 1-10	5,659	---	---	---	---	---	.200	.002	.013	.599	.395	.087	.043	.000	1.457	.051	.005	.016	---	---	---	---
July 11-20	1,575	---	---	---	---	---	.389	.011	.022	1.048	.674	.174	.056	.000	2.562	.102	.005	.016	---	---	---	---
July 21-31	1,859	---	---	---	---	---	.389	.015	.018	1.198	.732	.244	.067	.000	2.852	.079	.011	.016	---	---	---	---
Aug. 1-10	2,628	---	---	---	---	---	.289	.009	.011	.998	.609	0.084		.000	2.103	.073	.005	.023	---	---	---	---
Aug. 11-20	1,934	---	---	---	---	---	.200	.003	.015	.848	.502	.152	.059	.000	1.832	.079	.005	.016	---	---	---	---
Aug. 21-31	1,410	---	---	---	---	---	.234	.005	.017	.948	.551	.183	.041	.000	1.999	.082	.005	.018	---	---	---	---
Sept. 1-10	577	---	---	---	---	---	.456	.012	.029	1.297	.798	.274	.054	.000	2.856	.107	.011	.020	---	---	---	---
Sept. 11-20	623	---	---	---	---	---	.545	.012	.029	1.547	.987	.322	.051	.000	3.602	.141	.011	.019	---	---	---	---
Sept. 21-30	931	---	---	---	---	---	.545	.017	.029	1.597	.987	.344	.056	.000	3.727	.141	.011	.015	---	---	---	---
Average	6,416	---	---	---	---	---	0.189	0.004	0.011	0.699	0.423	0.143	0.036	0.000	1.499	0.065	0.005	0.015	---	---	---	---

P 88.42
8.1.0

MERCE
ROCEDURE
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West Branch Susquehanna River at Lewisburg, Pa.

Chemical analyses, in parts per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																			Total	Non-carbonate
Oct. 1-10, 1944---	1,368	61	5	6.7	31.8	5.2	0.02	---	37	10	11	2.5	8	128	10	0.2	1.5	219	133	127
Oct. 11-20--------	1,916	58	5	6.5	26.0	4.4	.01	0.2	27	8.3	9.7	1.9	8	96	7.0	.1	1.4	166	102	95
Oct. 21-31--------	4,276	50	7	5.5	20.8	4.8	.02	.4	21	6.5	6.5	2.9	4	79	4.6	.1	1.1	132	79	76
Nov. 1-10---------	1,772	49	5	6.6	17.9	4.8	.02	.4	18	5.4	5.3	2.0	11	60	5.1	.1	1.6	106	67	58
Nov. 11-20--------	1,841	46	4	6.9	20.4	5.8	.01	.4	20	6.4	6.9	2.1	14	67	5.8	.1	1.0	125	76	65
Nov. 21-30--------	2,766	40	4	6.4	21.7	4.4	.02	.4	22	7.2	7.5	1.8	6	81	5.2	.2	1.3	135	84	80
Dec. 1-10---------	4,414	33	5	6.6	16.1	5.4	.03	.2	16	5.2	5.4	1.7	10	54	4.2	.1	2.1	98	61	53
Dec. 11-20--------	5,683	32	5	6.7	13.2	4.7	.02	.2	14	4.3	3.6	1.1	8	44	3.2	.1	2.3	82	53	46
Dec. 21-31--------	5,345	31	4	6.4	14.7	5.2	.02	.2	15	4.9	3.8	1.4	8	50	4.0	.1	1.6	93	58	51
Jan. 1-10, 1945---	13,020	32	3	6.2	10.7	4.8	.01	.2	10	3.5	3.7	1.0	5	37	2.1	.1	1.7	68	39	35
Jan. 11-20--------	5,600	32	8	6.2	12.2	5.1	.01	.1	12	4.1	3.6	.6	6	42	3.0	.1	1.5	76	47	42
Jan. 21-31--------	4,200	32	8	6.0	15.5	5.3	.01	.2	16	4.9	4.4	.8	6	54	3.8	.1	1.7	97	60	55
Feb. 1-10---------	3,810	32	6	6.1	16.7	5.2	.01	.2	17	5.3	3.3	.9	6	58	4.2	.1	1.8	105	64	59
Feb. 11-20--------	6,690	32	4	5.5	17.0	4.7	.02	.3	18	4.8	4.4	.9	3	63	4.0	.2	1.9	108	65	62
Feb. 21-28--------	29,180	32	5	5.7	11.1	3.4	.02	.2	11	3.4	2.7	.9	3	38	2.2	.0	2.1	68	41	39
Mar. 1-10---------	64,820	38	8	4.9	8.62	4.0	.03	.2	8.1	2.7	1.5	.4	1	28	2.0	.1	1.2	53	31	30
Mar. 11-20--------	43,550	45	3	5.3	8.28	4.1	.02	.0	7.9	2.5	1.7	.6	2	29	1.6	.1	1.0	53	30	28
Mar. 21-31--------	40,140	50	3	5.7	8.39	4.3	.02	.0	8.5	2.7	1.8	.6	3	29	1.8	.1	1.0	54	32	30
Apr. 1-10---------	20,910	53	2	6.0	9.80	5.0	.02	.1	9.6	3.0	2.2	.9	5	34	1.6	.1	1.0	61	36	32
Apr. 11-20--------	11,160	58	7	6.2	11.3	4.1	.01	.2	12	3.6	2.6	1.0	5	39	2.4	.1	.8	71	45	41
Apr. 21-30--------	18,710	52	3	5.9	10.7	4.0	.01	.1	11	3.5	2.4	.9	4	38	2.0	.1	.6	68	42	39
May 1-10----------	27,970	49	7	6.1	7.46	2.1	.02	.1	8.0	2.3	1.9	.4	6	25	1.5	.1	.6	46	29	24
May 11-20---------	36,230	56	10	5.9	7.83	4.2	.03	.1	8.6	2.5	1.7	.7	6	27	1.5	.1	.6	48	32	27
May 21-31---------	18,140	60	8	6.3	9.45	4.4	.03	.2	9.2	2.9	1.5	.8	6	30	1.6	.1	.8	60	35	30
June 1-10---------	18,650	55	7	6.4	8.91	4.5	.02	.2	9.3	2.7	1.8	1.2	6	29	2.0	.2	.8	58	34	29
June 11-20--------	7,660	72	6	6.6	11.8	4.3	.02	.2	12	3.5	2.7	1.0	8	39	2.6	.1	.8	76	44	38
June 21-30--------	5,282	77	9	6.8	14.3	4.3	.03	.3	15	4.4	3.4	1.3	12	47	3.1	.1	1.0	91	56	46
July 1-10---------	4,122	76	8	6.7	14.2	4.8	.02	.0	15	4.2	4.1		14	44	3.2	.1	1.8	89	55	43
July 11-20--------	2,690	74	8	6.9	18.6	4.6	.02	.0	18	5.0	5.6		14	62	4.2	.1	1.8	113	65	54
July 21-31--------	3,674	77	7	6.7	18.2	4.5	.02	.0	18	5.4	5.7	1.3	13	60	4.5	.1	1.9	112	67	56
Aug. 1-10---------	5,563	74	3	6.7	14.5	5.5	.02	.0	14	4.3	4.1	1.2	8	49	3.2	.1	1.2	89	53	46
Aug. 11-20--------	2,347	77	5	6.7	16.7	4.2	.02	.0	17	5.2	4.0	1.4	16	54	3.8	.1	1.7	102	64	51
Aug. 21-31--------	1,971	73	3	6.9	18.3	2.9	.01	.0	19	5.8	5.4	1.5	25	53	4.9	.1	1.7	110	71	51
Sept. 1-10--------	1,414	78	3	6.6	23.9	5.2	.02	.0	24	7.6	7.7	1.8	14	83	5.5	.1	1.6	152	91	80
Sept. 11-20-------	5,731	68	8	6.7	21.6	3.4	.02	.1	22	6.5	8.0	1.3	22	68	6.2	.1	1.9	132	82	64
Sept. 21-30-------	11,280	64	10	6.3	12.5	5.1	.02	.1	13	3.5	3.2	1.0	4	43	2.5	.1	.8	77	47	44
Average---------	10,530	53	6	6.3	15.0	4.5	0.02	0.2	15	4.7	4.2	1.2	8	52	3.6	0.1	1.4	94	57	50

Chemical analyses, in equivalents per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																			Total	Non-carbonate
Oct. 1-10, 1944	1,368	---	---	---	---	---	---	---	1.847	0.822	0.478	0.064	0.131	2.665	0.282	0.011	0.024	---	---	---
Oct. 11-20	1,916	---	---	---	---	---	---	---	1.348	.683	.422	.049	.131	1.999	.197	.005	.023	---	---	---
Oct. 21-31	4,276	---	---	---	---	---	---	---	1.048	.535	.283	.074	.066	1.645	.130	.005	.018	---	---	---
Nov. 1-10	1,772	---	---	---	---	---	---	---	.898	.444	.230	.051	.180	1.250	.144	.005	.026	---	---	---
Nov. 11-20	1,841	---	---	---	---	---	---	---	.998	.526	.300	.054	.229	1.395	.164	.005	.016	---	---	---
Nov. 21-30	2,766	---	---	---	---	---	---	---	1.098	.592	.326	.046	.098	1.686	.147	.011	.021	---	---	---
Dec. 1-10	4,414	---	---	---	---	---	---	---	.799	.428	.235	.043	.164	1.124	.118	.005	.034	---	---	---
Dec. 11-20	5,683	---	---	---	---	---	---	---	.699	.354	.157	.028	.131	.916	.090	.005	.037	---	---	---
Dec. 21-31	5,345	---	---	---	---	---	---	---	.749	.403	.165	.036	.131	1.041	.113	.005	.026	---	---	---
Jan. 1-10, 1945	13,020	---	---	---	---	---	---	---	.499	.288	.161	.026	.082	.770	.059	.005	.027	---	---	---
Jan. 11-20	5,600	---	---	---	---	---	---	---	.599	.337	.157	.015	.098	.874	.085	.005	.024	---	---	---
Jan. 21-31	4,200	---	---	---	---	---	---	---	.799	.403	.191	.020	.098	1.124	.107	.005	.027	---	---	---
Feb. 1-10	3,810	---	---	---	---	---	---	---	.848	.436	.144	.023	.098	1.208	.118	.005	.029	---	---	---
Feb. 11-20	6,690	---	---	---	---	---	---	---	.898	.395	.191	.023	.049	1.312	.113	.011	.031	---	---	---
Feb. 21-28	29,180	---	---	---	---	---	---	---	.549	.280	.117	.023	.049	.791	.062	.000	.034	---	---	---
Mar. 1-10	64,820	---	---	---	---	---	---	---	.404	.222	.065	.010	.016	.583	.056	.005	.019	---	---	---
Mar. 11-20	43,550	---	---	---	---	---	---	---	.394	.206	.074	.015	.033	.604	.045	.005	.016	---	---	---
Mar. 21-31	40,140	---	---	---	---	---	---	---	.424	.222	.078	.015	.049	.604	.051	.005	.016	---	---	---
Apr. 1-10	20,910	---	---	---	---	---	---	---	.479	.247	.096	.023	.082	.708	.045	.005	.016	---	---	---
Apr. 11-20	11,160	---	---	---	---	---	---	---	.599	.296	.113	.026	.082	.812	.068	.005	.013	---	---	---
Apr. 21-30	18,710	---	---	---	---	---	---	---	.549	.288	.104	.023	.066	.791	.056	.005	.010	---	---	---
May 1-10	27,970	---	---	---	---	---	---	---	.399	.189	.083	.010	.098	.520	.042	.005	.010	---	---	---
May 11-20	36,230	---	---	---	---	---	---	---	.429	.206	.074	.018	.098	.562	.042	.005	.010	---	---	---
May 21-31	18,140	---	---	---	---	---	---	---	.459	.238	.065	.020	.098	.625	.045	.005	.013	---	---	---
June 1-10	18,650	---	---	---	---	---	---	---	.464	.222	.078	.031	.098	.604	.056	.011	.013	---	---	---
June 11-20	7,660	---	---	---	---	---	---	---	.599	.288	.117	.026	.131	.812	.073	.005	.013	---	---	---
June 21-30	5,232	---	---	---	---	---	---	---	.749	.362	.148	.033	.197	.979	.087	.005	.016	---	---	---
July 1-10	4,122	---	---	---	---	---	---	---	.749	.345	0.178		.229	.916	.090	.005	.029	---	---	---
July 11-20	2,690	---	---	---	---	---	---	---	.898	.411	.244		.229	1.291	.118	.005	.029	---	---	---
July 21-31	3,674	---	---	---	---	---	---	---	.898	.444	.248	.033	.213	1.249	.127	.005	.031	---	---	---
Aug. 1-10	5,563	---	---	---	---	---	---	---	.699	.354	.178	.031	.131	1.020	.090	.005	.019	---	---	---
Aug. 11-20	2,347	---	---	---	---	---	---	---	.848	.428	.174	.036	.262	1.124	.107	.005	.027	---	---	---
Aug. 21-31	1,971	---	---	---	---	---	---	---	.948	.477	.235	.038	.410	1.103	.138	.005	.027	---	---	---
Sept. 1-10	3,414	---	---	---	---	---	---	---	1.198	.625	.335	.046	.229	1.728	.155	.005	.026	---	---	---
Sept. 11-20	5,731	---	---	---	---	---	---	---	1.098	.534	.348	.033	.361	1.416	.175	.005	.031	---	---	---
Sept. 21-30	11,280	---	---	---	---	---	---	---	.649	.288	.139	.026	.066	.895	.071	.005	.013	---	---	---
Average	10,530	---	---	---	---	---	---	---	0.749	0.387	0.183	0.031	0.131	1.083	0.102	0.005	0.023	---	---	---

West Branch Susquehanna River at Lewisburg, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($Fx10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																		Total	Non-carbonate
Oct. 1-10, 1945	15,820	54	7	6.6	10.0	5.4	0.03	0.10	10	3.6	4.4	6	27	2.0	0.1	1.0	63	39	33
Oct. 11-20	3,884	51	4	6.6	11..	4.6	.01	.06	11	3.6	4.6	12	30	2.6	.1	1.1	67	42	32
Oct. 21-31	5,457	51	3	6.4	12..	4.6	.01	.12	14	4..	4.1	12	36	3.2	.1	1.2	85	53	44
Nov. 1-10	11,430	47	6	6.5	11.4	4.7	.02	.14	11	3.4	3.6	10	30	2.6	.1	.8	66	41	33
Nov. 11-20	15,820	45	3	6..	9.0	4..	.04	.07	8..	2.4	4.6	8	24	2.1	.1	.7	55	32	24
Nov. 21-30	32,960	38	4	6.2	8.14	4.7	.12	.0	8.4	2.7	2.6	7	26	1.9	.1	1.3	51	32	26
Dec. 1-10	25,370	37	4	6.6	8.6	4.4	.03	.20	8.	2.9	2.1	8	19	2.0	.1	1.3	57	34	28
Dec. 11-20	11,010	33	6	6.7	10.6	4.3	.01	.10	10	4.0	1.6	10	34	2..	.1	1.6	67	46	38
Dec. 21-31	7,037	33	8	6.7	11.4	4.6	.02	.2.	14	4..	1.4	12	41	3.0	.1	3.4	83	53	40
Jan. 1-10, 1946	21,010	35	6	6.6	12.1	4.9	.02	.14	11	3.7	1.6	8	30	2.8	.1	1.6	74	43	36
Jan. 11-20	21,560	35	2	6.5	8.5	4.4	.01	.06	.1	2..	1.3	7	27	2.0	.1	1.3	52	31	25
Jan. 21-31	6,150	32	3	6.5	12..	4.6	.02	.17	12	4..	1..	10	39	3.1	.1	1.9	78	49	36
Feb. 1-10	4,348	33	2	6.8	16.0	4.7	.01	.20	16	5.9	1.7	14	52	4.0	.1	1.5	103	62	51
Feb. 11-20	4,729	33	2	6.7	17.0	4.6	.03	.20	18	6..	1.9	14	6..	3.8	.1	2.2	103	69	58
Feb. 21-28	6,244	33	10	6.8	12.7	4.4	.03	.11	12	4.8	1.8	14	41	4.0	.1	1.6	94	62	51
Mar. 1-10	36,280	40	4	6.7	8.07	4.3	.04	.06	7..	2.6	2.3	8	24	1.9	.1	1.2	48	29	24
Mar. 11-20	33,610	45	7	6.4	7.52	4.7	.04	.10	7.8	2.1	2.2	6	23	1.8	.1	1.2	47	27	22
Mar. 21-31	19,740	49	5	6.8	9.72	4.1	.05	.13	10	3..	4.3	14	31	2.4	.1	1.0	58	38	27
Apr. 1-10	8,567	47	15	6.8	12.1	4.1	.02	.16	12	3.8	1.2	15	37	3.0	.1	1.3	72	46	35
Apr. 11-20	5,001	52	3	6.8	14.2	3.8	.03	.15	14	4.6	4.6	14	44	3.8	.1	1.1	85	54	42
Apr. 21-30	3,893	58	5	7.1	15.9	4.3	.03	.10	16	5.0	4.8	12	52	3.9	.1	1.4	98	60	51
May 1-10	4,157	57	4	6.7	16.5	3.1	.02	.10	16	5.0	6.0	14	53	4.2	.1	.9	99	60	49
May 11-20	11,040	58	8	6.5	11.2	3.3	.02	.18	11	3.3	4.1	9	37	2.5	.1	.4	72	41	34
May 21-31	66,100	62	13	6.6	7.20	4.9	.20	.10	7.0	2.1	4.2	12	22	1.2	.1	.6	53	26	16
June 1-10	30,140	59	2	6.6	8.97	4.3	.02	.08	9.2	2.8	2.8	7	29	2.4	.1	1.1	57	34	29
June 11-20	19,630	65	3	6.6	11.3	5.1	.02	.11	11	3.3	4.8	10	37	2.4	.1	1.3	69	41	33
June 21-30	11,520	71	3	6.3	13.4	4.9	.02	.28	13	4.3	4.8	6	49	2.8	.1	.7	83	50	45
July 1-10	8,654	76	2	6.6	14.2	4.5	.01	.28	14	4.7	4.4	8	51	2.2	.1	1.2	99	54	48
July 11-20	3,467	79	3	7.0	18.5	4.7	.01	.07	18	6.1	5.0	11	63	3.4	.1	1.6	112	70	61
July 21-31	3,785	77	3	6.8	21.6	4.1	.02	.09	21	6.9	6.4	7	78	4.5	---	1.7	138	81	75
Aug. 1-10	6,121	72	3	6.9	16.9	4.2	.02	.00	18	5.2	4.7	18	53	3.8	---	1.5	105	66	52
Aug. 11-20	3,862	73	3	7.0	16.3	4.5	.01	.00	17	5.2	4.6	17	51	3.9	---	1.6	100	64	50
Aug. 21-31	3,160	69	2	6.9	19.9	4.1	.02	.07	20	6.6	5.8	15	69	4.5	---	1.1	124	77	66
Sept. 1-10	1,657	72	6	7.0	20.6	5.0	.01	.00	21	6.4	7.1	28	59	6.2	---	1.2	124	79	56
Sept. 11-20	1,554	70	8	7.0	25.3	2.8	.02	---	27	8.3	7.5	34	74	7.9	.1	2.2	153	102	74
Sept. 21-30	2,924	69	7	6.7	21.6	3.6	.01	.00	23	7.0	5.8	21	68	6.0	.1	2.5	134	86	69
Average	13,840	53	5	6.7	13.6	4.3	0.03	0.11	14	4.3	4.1	12	44	3.2	0.1	1.4	84	53	43

West Branch Susquehanna River at Lewisburg, Pa.

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate
Oct. 1-10, 1945	16,820	---	---	---	---	---	---	---	0.499	0.288	0.191	0.131	0.770	0.056	0.005	0.016	---	---	---
Oct. 11-20	8,834	---	---	---	---	---	---	---	.549	.296	.174	.197	.729	.070	.005	.018	---	---	---
Oct. 21-31	5,857	---	---	---	---	---	---	---	.699	.370	.179	.197	.937	.090	.005	.019	---	---	---
Nov. 1-10	11,430	---	---	---	---	---	---	---	.549	.260	.155	.164	.729	.073	.005	.013	---	---	---
Nov. 11-20	18,320	---	---	---	---	---	---	---	.439	.197	.194	.147	.604	.059	.006	.015	---	---	---
Nov. 21-30	32,950	---	---	---	---	---	---	---	.419	.222	.095	.115	.541	.054	.005	.021	---	---	---
Dec. 1-10	25,370	---	---	---	---	---	---	---	.444	.238	.135	.131	.604	.056	.005	.021	---	---	---
Dec. 11-20	11,010	---	---	---	---	---	---	---	.599	.329	.045	.164	.708	.070	.005	.026	---	---	---
Dec. 21-31	7,097	---	---	---	---	---	---	---	.699	.354	.192	.246	.854	.085	.005	.055	---	---	---
Jan. 1-10, 1946	21,010	---	---	---	---	---	---	---	.549	.304	.200	.131	.812	.079	.005	.026	---	---	---
Jan. 11-20	21,560	---	---	---	---	---	---	---	.404	.214	.141	.115	.562	.056	.005	.021	---	---	---
Jan. 21-31	6,150	---	---	---	---	---	---	---	.649	.329	.219	.262	.812	.087	.005	.031	---	---	---
Feb. 1-10	4,348	---	---	---	---	---	---	---	.798	.452	.204	.229	1.083	.113	.005	.024	---	---	---
Feb. 11-20	4,729	---	---	---	---	---	---	---	.898	.477	.194	.213	1.208	.107	.005	.036	---	---	---
Feb. 21-28	6,299	---	---	---	---	---	---	---	.798	.452	.185	.229	1.062	.113	.005	.026	---	---	---
Mar. 1-10	30,980	---	---	---	---	---	---	---	.394	.181	.101	.098	.500	.054	.005	.019	---	---	---
Mar. 11-20	33,810	---	---	---	---	---	---	---	.374	.173	.096	.098	.479	.042	.005	.019	---	---	---
Mar. 21-31	16,740	---	---	---	---	---	---	---	.499	.263	.186	.213	.645	.068	.005	.016	---	---	---
Apr. 1-10	8,567	---	---	---	---	---	---	---	.599	.312	.183	.213	.770	.085	.005	.021	---	---	---
Apr. 11-20	5,001	---	---	---	---	---	---	---	.699	.378	.198	.229	.916	.107	.005	.018	---	---	---
Apr. 21-30	3,898	---	---	---	---	---	---	---	.798	.411	.210	.197	1.083	.111	.005	.023	---	---	---
May 1-10	4,157	---	---	---	---	---	---	---	.798	.411	.261	.229	1.103	.118	.005	.015	---	---	---
May 11-20	11,040	---	---	---	---	---	---	---	.549	.271	.179	.147	.770	.071	.005	.006	---	---	---
May 21-31	66,190	---	---	---	---	---	---	---	.349	.173	.182	.197	.458	.034	.005	.010	---	---	---
June 1-10	30,140	---	---	---	---	---	---	---	.459	.230	.121	.115	.604	.068	.005	.018	---	---	---
June 11-20	19,630	---	---	---	---	---	---	---	.549	.271	.208	.164	.770	.068	.005	.021	---	---	---
June 21-30	11,520	---	---	---	---	---	---	---	.649	.354	.210	.098	1.020	.079	.005	.011	---	---	---
July 1-10	8,654	---	---	---	---	---	---	---	.699	.387	.193	.131	1.062	.062	.005	.019	---	---	---
July 11-20	3,487	---	---	---	---	---	---	---	.898	.502	.219	.180	1.312	.096	.005	.026	---	---	---
July 21-31	3,785	---	---	---	---	---	---	---	1.048	.567	.278	.115	1.624	.127	---	.027	---	---	---
Aug. 1-10	6,121	---	---	---	---	---	---	---	.898	.428	.203	.295	1.103	.107	---	.024	---	---	---
Aug. 11-20	3,862	---	---	---	---	---	---	---	.848	.428	.202	.279	1.062	.111	---	.026	---	---	---
Aug. 21-31	3,160	---	---	---	---	---	---	---	.998	.543	.254	.213	1.437	.127	---	.018	---	---	---
Sept. 1-10	1,657	---	---	---	---	---	---	---	1.048	.526	.307	.459	1.223	.175	---	.019	---	---	---
Sept. 11-20	1,554	---	---	---	---	---	---	---	1.347	.683	.328	.557	1.541	.220	.005	.035	---	---	---
Sept. 21-30	2,924	---	---	---	---	---	---	---	1.148	.576	.250	.344	1.416	.169	.005	.040	---	---	---
Average	13,840	---	---	---	---	---	---	---	0.699	0.354	0.178	0.197	0.916	0.090	0.005	0.023	---	---	---

P 38.46
3.14

MERCE

ROCEDURE

a State Libra

Juniata River at Newport, Pa.

Chemical analyses, in parts per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																			Total	Non-carbonate
Oct. 1-10, 1944	649	59	37	7.6	44.4	4.8	0.12	—	44	14	30	2.7	130	92	15	0.2	1.2	282	167	61
Oct. 11-20	689	55	40	7.6	41.5	2.6	.11	0.0	40	13	26	2.8	124	92	13	.2	1.4	252	153	52
Oct. 21-31	2,163	46	30	7.2	32.1	4.0	.14	.0	34	10	14	3.2	89	69	7.8	.2	2.8	195	126	53
Nov. 1-10	684	49	40	7.3	35.5	5.8	.13	.1	34	9.4	23	3.0	96	78	10	.1	2.4	221	124	45
Nov. 11-20	625	45	37	7.5	38.9	5.2	.16	.0	36	10	27	2.9	109	82	12	.1	1.8	243	131	42
Nov. 21-30	760	38	85	7.4	38.6	5.6	.35	.0	38	11	27	2.0	122	76	13	.5	2.0	243	140	40
Dec. 1-10	1,434	33	55	7.4	29.6	6.6	.24	.0	31	8.7	17	2.2	98	54	9.5	.4	2.4	184	113	33
Dec. 11-20	2,368	33	35	7.4	25.2	6.0	.16	.0	28	7.6	12	2.2	75	49	7.0	.3	3.8	155	101	40
Dec. 21-31	1,833	32	40	7.2	28.1	5.8	.14	.0	31	8.8	14	2.3	88	56	8.2	.2	4.1	180	114	41
Jan. 1-10, 1945	2,480	32	20	7.1	20.8	5.6	.08	.0	25	6.3	8.3	1.4	60	45	5.0	.1	6.0	129	88	39
Jan. 11-20	1,610	32	25	7.1	25.9	5.6	.13	.0	29	7.4	11	1.2	72	51	7.5	.1	5.1	162	103	44
Jan. 21-31	1,441	32	35	7.1	29.7	4.0	.08	—	30	8.0	17	2.2	79	65	9.0	.1	4.3	184	108	43
Feb. 1-10	1,410	32	33	6.9	30.5	4.2	.14	—	32	8.5	18	1.8	88	63	9.0	.2	5.1	192	115	43
Feb. 11-20	7,332	32	30	6.9	20.8	5.8	.14	—	24	6.1	9.6	1.6	62	42	6.0	.2	6.9	137	85	34
Feb. 21-28	12,190	35	23	7.0	15.0	6.2	.14	—	19	4.3	4.7	.9	42	27	3.5	.2	6.7	96	65	31
Mar. 1-10	21,940	41	30	7.2	12.4	6.0	.19	.0	15	3.5	3.3	1.2	34	22	2.5	.1	4.9	78	52	24
Mar. 11-20	8,111	47	9	7.0	15.4	5.6	.06	.0	18	4.7	4.3	.9	47	26	3.5	.1	4.6	94	64	26
Mar. 21-31	9,642	54	20	7.1	15.1	6.3	.16	.0	18	4.8	3.7	1.0	49	24	3.1	.1	4.1	95	65	24
Apr. 1-10	8,784	56	20	7.1	15.5	6.7	.16	.0	18	4.7	4.7	1.3	53	25	3.2	.1	3.3	94	64	21
Apr. 11-20	5,278	58	25	7.2	16.6	4.6	.07	.0	19	5.0	5.0	1.2	56	28	3.6	.1	3.1	98	68	22
Apr. 21-30	7,566	53	20	7.2	15.2	5.8	.10	—	18	4.8	4.7	.6	48	26	3.0	.1	2.8	92	65	25
May 1-10	6,406	53	13	7.3	15.1	4.7	.08	.0	17	4.4	5.0	1.2	50	25	3.4	.1	2.8	89	60	20
May 11-20	11,140	57	22	7.1	15.0	5.4	.11	.0	17	4.3	5.0	1.0	50	25	2.9	.1	2.5	91	60	19
May 21-31	6,565	61	24	7.2	16.4	5.8	.08	.0	19	4.7	5.4	1.2	57	26	3.0	.1	2.9	99	67	20
June 1-10	3,622	62	16	7.3	19.8	5.2	.08	.0	23	5.8	7.2	1.4	69	32	3.9	.1	3.6	117	81	25
June 11-20	2,839	74	18	7.3	22.5	3.8	.06	.0	27	6.9	7.5	1.7	78	37	5.2	.2	2.8	138	96	32
June 21-30	2,345	78	19	7.4	24.1	3.8	.06	.0	28	7.4	9.3	1.5	84	41	5.5	.2	2.5	146	100	31
July 1-10	1,315	78	18	7.5	26.8	2.8	.04	.0	31	8.5	9.0	2.3	102	39	7.1	.1	2.5	157	112	29
July 11-20	1,170	74	20	7.6	29.6	2.0	.02	.0	33	9.4	12	1.4	102	47	8.5	.2	2.3	173	121	37
July 21-31	1,607	78	30	7.4	29.8	4.4	.12	.0	32	9.0	15	2.0	102	49	8.6	.1	2.6	177	117	33
Aug. 1-10	2,999	78	26	7.2	24.6	4.8	.05	.0	28	7.6	8.7	2.2	83	41	5.1	.2	4.2	151	101	33
Aug. 11-20	1,053	78	28	7.2	27.8	2.8	.02	.0	30	8.0	14	2.0	96	47	8.1	.2	2.0	165	108	29
Aug. 21-31	2,108	73	65	7.2	28.1	2.4	.12	.0	30	8.9	13	2.8	96	47	7.8	.2	1.7	169	111	33
Sept. 1-10	1,206	78	10	7.4	27.8	3.6	.04	.0	30	8.8	12	2.3	94	46	8.0	.1	2.4	166	111	34
Sept. 11-20	5,656	68	33	7.1	28.2	2.8	.08	.0	30	8.1	12	2.3	90	44	9.0	.1	2.4	159	108	34
Sept. 21-30	6,253	66	—	7.0	19.7	8.8	.14	.0	23	5.5	5.0	2.2	64	31	3.9	.1	4.4	116	80	28
Average	4,257	54	29	7.2	25.1	4.9	0.11	0.0	27	7.4	11	1.8	79	46	6.8	0.2	3.3	153	98	33

Chemical analyses, in equivalents per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate
Oct. 1-10, 1944	649	---	---	---	---	---	---	---	2.196	1.151	1.304	0.069	2.131	1.915	0.423	0.011	0.019	---	---	---
Oct. 11-20	689	---	---	---	---	---	---	---	1.997	1.069	1.131	.072	2.032	1.915	.367	.011	.023	---	---	---
Oct. 21-31	2,163	---	---	---	---	---	---	---	1.697	.822	.609	.082	1.459	1.436	.220	.011	.045	---	---	---
Nov. 1-10	684	---	---	---	---	---	---	---	1.697	.773	1.000	.077	1.573	1.624	.282	.005	.039	---	---	---
Nov. 11-20	625	---	---	---	---	---	---	---	1.797	.822	1.174	.074	1.787	1.707	.338	.005	.029	---	---	---
Nov. 21-30	760	---	---	---	---	---	---	---	1.897	.905	1.174	.051	2.000	1.582	.367	.026	.032	---	---	---
Dec. 1-10	1,434	---	---	---	---	---	---	---	1.547	.715	.739	.056	1.606	1.124	.268	.021	.039	---	---	---
Dec. 11-20	2,368	---	---	---	---	---	---	---	1.398	.625	.522	.056	1.229	1.020	.197	.016	.061	---	---	---
Dec. 21-31	1,833	---	---	---	---	---	---	---	1.547	.724	.609	.059	1.442	1.166	.231	.011	.066	---	---	---
Jan. 1-10, 1945	2,480	---	---	---	---	---	---	---	1.248	.518	.361	.036	.984	.937	.141	.005	.097	---	---	---
Jan. 11-20	1,610	---	---	---	---	---	---	---	1.448	.609	.478	.031	1.180	1.062	.212	.005	.082	---	---	---
Jan. 21-31	1,441	---	---	---	---	---	---	---	1.497	.658	.739	.056	1.295	1.353	.254	.005	.069	---	---	---
Feb. 1-10	1,410	---	---	---	---	---	---	---	1.597	.699	.783	.046	1.442	1.312	.254	.011	.082	---	---	---
Feb. 11-20	7,332	---	---	---	---	---	---	---	1.198	.502	.417	.041	1.016	.874	.169	.011	.111	---	---	---
Feb. 21-28	12,190	---	---	---	---	---	---	---	.948	.354	.204	.023	.688	.562	.099	.011	.108	---	---	---
Mar. 1-10	21,940	---	---	---	---	---	---	---	.749	.288	.144	.031	.557	.458	.071	.005	.079	---	---	---
Mar. 11-20	8,111	---	---	---	---	---	---	---	.838	.387	.187	.023	.770	.541	.099	.005	.074	---	---	---
Mar. 21-31	9,642	---	---	---	---	---	---	---	.898	.395	.161	.026	.803	.500	.087	.005	.066	---	---	---
Apr. 1-10	8,784	---	---	---	---	---	---	---	.898	.387	.204	.033	.869	.520	.090	.005	.053	---	---	---
Apr. 11-20	5,278	---	---	---	---	---	---	---	.948	.411	.217	.031	.918	.583	.102	.005	.050	---	---	---
Apr. 21-30	7,566	---	---	---	---	---	---	---	.898	.395	.204	.015	.787	.541	.085	.005	.045	---	---	---
May 1-10	6,406	---	---	---	---	---	---	---	.848	.362	.217	.031	.819	.521	.096	.005	.045	---	---	---
May 11-20	11,140	---	---	---	---	---	---	---	.848	.354	.217	.026	.819	.521	.082	.005	.040	---	---	---
May 21-31	6,565	---	---	---	---	---	---	---	.948	.386	.235	.031	.934	.541	.085	.005	.047	---	---	---
June 1-10	3,622	---	---	---	---	---	---	---	1.148	.477	.313	.036	1.131	.666	.111	.005	.058	---	---	---
June 11-20	2,839	---	---	---	---	---	---	---	1.347	.567	.326	.044	1.278	.770	.147	.011	.045	---	---	---
June 21-30	2,345	---	---	---	---	---	---	---	1.397	.609	.404	.038	1.377	.854	.155	.011	.040	---	---	---
July 1-10	1,315	---	---	---	---	---	---	---	1.547	.699	.391	.059	1.672	.812	.200	.005	.040	---	---	---
July 11-20	1,170	---	---	---	---	---	---	---	1.647	.773	.522	.036	1.672	.979	.240	.011	.037	---	---	---
July 21-31	1,607	---	---	---	---	---	---	---	1.597	.740	.652	.051	1.672	1.020	.243	.005	.042	---	---	---
Aug. 1-10	2,999	---	---	---	---	---	---	---	1.397	.625	.378	.056	1.360	.854	.144	.011	.068	---	---	---
Aug. 11-20	1,053	---	---	---	---	---	---	---	1.497	.659	.609	.051	1.573	.979	.228	.011	.032	---	---	---
Aug. 21-31	2,108	---	---	---	---	---	---	---	1.497	.732	.565	.072	1.573	.979	.220	.011	.027	---	---	---
Sept. 1-10	1,206	---	---	---	---	---	---	---	1.497	.724	.522	.059	1.541	.958	.226	.005	.039	---	---	---
Sept. 11-20	5,656	---	---	---	---	---	---	---	1.497	.666	.522	.059	1.475	.916	.254	.005	.039	---	---	---
Sept. 21-30	6,253	---	---	---	---	---	---	---	1.148	.452	.217	.056	1.049	.645	.111	.005	.071	---	---	---
Average	4,257	---	---	---	---	---	---	---	1.347	0.609	0.478	0.046	1.295	0.958	0.192	0.011	0.053	---	---	---

Juniata River at Newport, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																	Total	Noncarbonate
Oct. 1-10, 1945	3,560	58	27	7.2	23.6	6.0	0.15	28	7.5	7.6	82	38	4.9	0.1	4.1	141	101	34
Oct. 11-20	2,210	53	20	7.3	26.3	5.2	.13	30	7.7	11	88	44	5.9	.1	5.2	161	106	34
Oct. 21-31	1,490	54	30	7.3	30.7	5.8	.11	34	9.3	16	107	52	8.4	.2	5.2	185	123	35
Nov. 1-10	1,838	52	33	7.3	29.8	4.8	.12	32	9.3	16	103	52	8.1	.1	3.0	179	118	34
Nov. 11-20	3,736	47	20	7.3	24.0	5.2	.07	27	7.3	10	82	40	5.9	.1	3.0	141	97	30
Nov. 21-30	14,660	40	28	6.9	15.1	5.9	.18	18	4.6	4.3	50	25	3.2	.2	1.5	93	64	23
Dec. 1-10	10,870	39	19	7.0	14.9	6.0	.12	17	4.7	5.2	49	24	2.8	.2	4.0	90	62	22
Dec. 11-20	4,292	32	12	7.3	19.5	6.0	.12	22	6.6	6.3	64	33	4.1	.1	3.7	117	82	30
Dec. 21-31	2,845	32	13	7.3	21.9	4.8	.05	26	7.1	6.9	77	34	4.8	.1	4.3	132	94	31
Jan. 1-10, 1946	9,020	35	20	7.2	18.2	5.6	.06	19	5.2	9.2	59	30	4.0	.1	4.0	110	69	20
Jan. 11-20	8,478	36	9	7.2	15.4	5.8	.09	17	4.8	6.1	50	25	3.2	.1	4.6	94	62	21
Jan. 21-31	3,127	33	9	7.3	22.0	5.8	.07	24	6.9	9.2	73	36	5.2	.1	4.3	130	88	28
Feb. 1-10	2,405	33	8	7.3	25.4	5.0	.06	28	7.9	10	83	43	5.9	.1	4.5	151	102	34
Feb. 11-20	2,940	34	13	7.2	24.5	4.6	.08	27	7.6	9.8	76	44	5.9	.1	4.1	150	99	36
Feb. 21-28	3,141	35	22	7.3	23.5	4.2	.13	26	7.4	9.4	74	42	5.5	.2	3.8	142	95	35
Mar. 1-10	11,550	41	28	7.0	14.7	5.6	.05	19	3.9	5.3	44	29	3.5	.2	4.1	98	63	27
Mar. 11-20	11,720	46	24	7.3	14.0	5.8	.02	16	3.8	4.1	42	22	3.0	.1	3.3	82	55	21
Mar. 21-31	8,902	51	25	7.2	14.7	5.5	.18	17	4.6	5.1	50	23	3.5	.1	2.9	88	61	21
Apr. 1-10	4,793	50	22	7.4	17.3	4.2	.18	20	5.7	4.5	58	27	3.5	.1	2.9	105	73	26
Apr. 11-20	2,696	53	13	7.3	22.5	2.8	.09	26	7.5	8.1	82	34	5.8	.1	2.8	132	96	28
Apr. 21-30	2,036	59	17	7.5	25.3	1.0	.07	29	8.6	9.2	92	40	6.5	.1	1.7	147	108	32
May 1-10	1,824	60	14	7.4	27.6	.4	.05	30	8.7	11	94	45	7.4	.1	1.2	167	111	34
May 11-20	6,622	62	22	7.2	19.6	2.9	.07	22	6.1	7.6	68	31	4.6	.1	2.3	121	80	24
May 21-31	15,110	63	30	7.1	12.2	6.4	.18	14	3.6	4.2	40	20	2.2	.1	2.4	78	50	17
June 1-10	15,390	62	12	7.3	13.5	6.6	.25	16	4.1	4.9	47	22	2.6	.1	2.7	90	57	18
June 11-20	11,190	66	22	7.3	15.8	7.2	.20	19	4.9	5.1	57	24	3.0	.1	3.0	97	68	21
June 21-30	6,752	69	10	7.5	17.8	5.8	.14	21	5.6	6.5	66	27	3.4	.1	3.1	107	75	21
July 1-10	3,338	76	13	7.5	21.7	3.8	.07	26	6.9	5.9	82	29	4.0	.1	3.5	139	93	26
July 11-20	1,795	77	5	7.7	27.5	2.2	.02	31	8.8	11	102	40	6.5	.1	3.2	158	114	30
July 21-31	1,597	79	7	7.4	30.0	.8	.03	33	9.5	14	107	48	7.5	---	3.3	179	121	34
Aug. 1-10	3,616	72	22	7.5	23.4	4.4	.09	27	7.6	7.4	83	35	5.4	---	3.2	138	99	31
Aug. 11-20	1,922	71	15	7.6	27.3	2.2	.04	30	8.6	11	90	48	6.0	---	3.2	160	110	36
Aug. 21-31	1,333	69	10	7.8	32.1	1.0	.03	35	11	14	108	60	8.2	---	1.7	192	133	44
Sept. 1-10	610	69	12	7.5	34.4	1.0	.02	36	11	19	119	60	10	.1	1.9	204	135	38
Sept. 11-20	930	68	15	7.6	36.6	1.2	.02	39	12	20	129	64	12	.1	1.4	218	147	41
Sept. 21-30	1,561	69	23	7.5	29.7	3.0	.03	34	9.6	12	104	50	8.5	.1	1.9	178	124	39
Average	5,286	54	18	7.3	22.6	4.3	0.09	25	7.1	9.4	77	37	5.4	0.1	3.2	136	92	28

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																	Total	Non-carbonate
Oct. 1-10, 1945	3,580	---	---	---	---	---	---	1.398	0.617	0.329	1.344	0.791	0.138	0.005	0.066	---	---	---
Oct. 11-20	2,210	---	---	---	---	---	---	1.497	.633	.483	1.442	.916	.166	.005	.084	---	---	---
Oct. 21-31	1,490	---	---	---	---	---	---	1.697	.765	.708	1.754	1.083	.237	.011	.084	---	---	---
Nov. 1-10	1,838	---	---	---	---	---	---	1.597	.765	.690	1.688	1.083	.228	.005	.048	---	---	---
Nov. 11-20	3,736	---	---	---	---	---	---	1.347	.600	.449	1.344	.833	.166	.005	.048	---	---	---
Nov. 21-30	14,660	---	---	---	---	---	---	.898	.378	.199	.819	.521	.090	.011	.024	---	---	---
Dec. 1-10	10,870	---	---	---	---	---	---	.848	.386	.224	.803	.500	.079	.011	.065	---	---	---
Dec. 11-20	4,292	---	---	---	---	---	---	1.098	.543	.276	1.049	.687	.116	.005	.060	---	---	---
Dec. 21-31	2,845	---	---	---	---	---	---	1.297	.584	.298	1.262	.708	.135	.005	.069	---	---	---
Jan. 1-10, 1946	9,020	---	---	---	---	---	---	.948	.428	.399	.967	.625	.113	.005	.065	---	---	---
Jan. 11-20	8,478	---	---	---	---	---	---	.848	.395	.266	.819	.521	.090	.005	.074	---	---	---
Jan. 21-31	3,127	---	---	---	---	---	---	1.198	.567	.402	1.196	.750	.147	.005	.069	---	---	---
Feb. 1-10	2,405	---	---	---	---	---	---	1.397	.650	.452	1.360	.895	.166	.005	.073	---	---	---
Feb. 11-20	2,940	---	---	---	---	---	---	1.347	.625	.427	1.246	.916	.166	.005	.066	---	---	---
Feb. 21-28	3,141	---	---	---	---	---	---	1.297	.609	.408	1.213	.874	.155	.011	.061	---	---	---
Mar. 1-10	11,550	---	---	---	---	---	---	.948	.321	.238	.721	.604	.099	.011	.066	---	---	---
Mar. 11-20	11,720	---	---	---	---	---	---	.798	.312	.179	.688	.458	.085	.005	.053	---	---	---
Mar. 21-31	8,902	---	---	---	---	---	---	.848	.378	.223	.819	.479	.099	.005	.047	---	---	---
Apr. 1-10	4,793	---	---	---	---	---	---	.998	.469	.197	.951	.562	.099	.005	.047	---	---	---
Apr. 11-20	2,696	---	---	---	---	---	---	1.297	.617	.352	1.344	.708	.164	.005	.045	---	---	---
Apr. 21-30	2,036	---	---	---	---	---	---	1.447	.707	.402	1.508	.833	.183	.005	.027	---	---	---
May 1-10	1,824	---	---	---	---	---	---	1.497	.715	.499	1.541	.937	.209	.005	.019	---	---	---
May 11-20	6,622	---	---	---	---	---	---	1.098	.502	.331	1.114	.645	.130	.005	.037	---	---	---
May 21-31	15,110	---	---	---	---	---	---	.699	.296	.183	.656	.416	.062	.005	.039	---	---	---
June 1-10	15,390	---	---	---	---	---	---	.798	.337	.215	.770	.458	.073	.005	.044	---	---	---
June 11-20	11,190	---	---	---	---	---	---	.948	.403	.221	.934	.500	.085	.005	.048	---	---	---
June 21-30	6,752	---	---	---	---	---	---	1.048	.461	.286	1.082	.562	.096	.005	.050	---	---	---
July 1-10	3,338	---	---	---	---	---	---	1.297	.567	.258	1.344	.604	.113	.005	.056	---	---	---
July 11-20	1,795	---	---	---	---	---	---	1.547	.724	.474	1.672	.833	.183	.005	.052	---	---	---
July 21-31	1,597	---	---	---	---	---	---	1.647	.781	.590	1.754	.999	.212	---	.053	---	---	---
Aug. 1-10	3,616	---	---	---	---	---	---	1.347	.625	.321	1.360	.729	.152	---	.052	---	---	---
Aug. 11-20	1,922	---	---	---	---	---	---	1.497	.707	.491	1.475	.999	.169	---	.052	---	---	---
Aug. 21-31	1,333	---	---	---	---	---	---	1.747	.905	.625	1.770	1.249	.231	---	.027	---	---	---
Sept. 1-10	810	---	---	---	---	---	---	1.796	.905	.816	1.950	1.249	.282	.005	.031	---	---	---
Sept. 11-20	930	---	---	---	---	---	---	1.946	.987	.879	2.114	1.332	.338	.005	.023	---	---	---
Sept. 21-30	1,561	---	---	---	---	---	---	1.697	.789	.535	1.704	1.041	.240	.005	.031	---	---	---
Average	5,286	---	---	---	---	---	---	1.248	0.584	0.409	1.262	0.770	0.152	0.005	0.052	---	---	---

Allegheny River at Kittanning, Pa.

Chemical analyses, in parts per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (K x10^5 at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate
Oct. 1-10, 1944---	2,952	64	15	7.1	38.6	1.0	0.03	---	34	7.3	30	2.2	67	48	52	0.1	0.4	231	115	60
Oct. 11-20--------	2,433	57	15	7.2	37.8	.6	.08	0.0	32	6.8	29	2.9	58	58	46	.0	.4	215	108	60
Oct. 21-31--------	4,914	50	15	7.1	36.4	2.0	.18	.0	31	6.6	27	2.2	56	52	50	.1	.4	210	104	59
Nov. 1-10---------	2,562	49	30	7.0	31.5	3.3	.28	---	28	6.6	24	2.0	46	51	40	.1	.5	182	97	59
Nov. 11-20--------	3,904	47	25	7.2	35.7	1.0	.29	---	33	7.3	27	2.0	60	54	46	.1	.3	205	112	63
Nov. 21-30--------	6,912	42	28	7.2	30.4	2.5	.29	---	28	6.6	20	1.8	54	44	39	.1	.4	173	97	53
Dec. 1-10---------	9,611	36	18	7.1	25.0	3.8	.28	.0	24	5.1	16	1.5	42	38	30	.2	.6	147	81	46
Dec. 11-20--------	11,150	34	15	6.7	20.5	4.4	.16	.0	20	4.3	12	1.5	28	38	21	.2	1.2	123	68	45
Dec. 21-31--------	10,080	34	15	6.9	22.2	4.5	.32	.0	22	5.1	11	1.4	38	45	18	.1	.8	136	76	45
Jan. 1-10, 1945---	14,950	34	15	6.7	19.5	4.8	.20	.0	19	4.3	10	1.6	26	40	18	.1	1.2	115	65	44
Jan. 11-20--------	8,741	34	10	6.8	20.3	5.1	.19	.0	20	4.6	11	1.3	30	37	20	.1	1.1	111	69	44
Jan. 21-31--------	5,920	34	10	6.8	23.6	4.9	.14	.2	23	5.4	13	1.1	34	49	21	.1	1.1	143	80	52
Feb. 1-10---------	4,950	34	10	7.0	26.2	3.4	.08	---	26	5.6	15	1.7	40	51	26	.0	1.2	155	88	55
Feb. 11-20--------	12,720	34	15	7.0	26.0	3.4	.12	---	25	5.5	14	2.2	40	46	25	.0	1.2	151	85	52
Feb. 21-28--------	62,920	35	15	6.2	15.3	4.5	.06	---	15	3.5	8.1	1.3	16	32	16	.2	2.8	95	52	39
Mar. 1-10---------	87,620	36	15	6.7	10.5	3.8	.05	.0	10	2.6	4.3	1.0	11	24	7.1	.1	2.1	63	36	27
Mar. 11-20--------	51,530	39	15	6.6	11.0	4.2	.16	.0	11	2.8	4.8	.4	14	24	8.0	.3	1.5	68	39	27
Mar. 21-31--------	67,270	50	15	6.6	10.1	4.8	.09	.0	10	2.6	4.1	1.0	13	22	6.8	.2	1.0	64	36	25
Apr. 1-10---------	47,160	53	20	6.5	11.5	5.1	.13	.0	11	2.6	5.5	1.0	17	25	7.9	.2	.9	70	38	24
Apr. 11-20--------	16,620	59	15	6.7	17.1	3.5	.36	.1	17	3.9	7.6	1.3	20	42	12	.1	.6	101	58	42
Apr. 21-30--------	20,350	55	10	6.9	17.6	2.9	.08	---	17	4.1	9.6	.7	24	36	15	.1	.6	103	59	40
May 1-10----------	20,130	52	10	6.7	15.3	2.9	.12	.0	14	3.3	8.2	1.2	20	31	13	.1	.6	88	48	32
May 11-20---------	33,060	58	12	6.7	13.0	3.4	.09	.0	12	3.0	6.8	1.2	20	25	11	.1	.8	77	42	26
May 21-31---------	15,200	64	12	6.7	16.9	3.9	.16	.1	16	3.8	8.3	1.0	20	40	12	.1	.6	100	56	39
June 1-10---------	14,300	62	15	6.8	17.6	3.1	.18	.0	16	3.7	9.9	1.1	27	35	14	.1	.8	104	55	33
June 11-20--------	16,790	73	17	6.8	17.1	3.4	.08	.0	16	3.6	9.2	1.4	29	31	15	.1	1.0	105	55	31
June 21-30--------	10,150	77	15	6.8	17.6	3.5	.20	.0	16	3.8	11		30	31	15	.1	1.0	106	56	31
July 1-10---------	5,253	80	12	7.0	22.8	1.9	.09	.0	21	4.5	15	1.6	37	38	23	.2	.4	132	71	41
July 11-20--------	9,295	76	12	6.9	23.4	1.8	.08	.0	20	4.5	16	1.6	38	37	24	.2	.8	145	68	37
July 21-31--------	6,345	78	20	6.9	19.7	3.0	.16	.0	17	3.8	14	1.4	28	33	21	.1	.8	115	58	35
Aug. 1-10---------	6,420	77	15	6.8	21.5	1.6	.13	.0	19	4.3	14	1.8	32	40	22	.1	.7	122	65	39
Aug. 11-20--------	3,776	78	12	6.9	24.6	2.4	.07	.0	21	5.0	17	2.0	37	42	25	.1	.9	138	73	43
Aug. 21-31--------	2,185	75	12	7.0	28.3	1.2	.02	.0	24	5.6	21	2.5	51	40	33	.2	.8	158	83	41
Sept. 1-10--------	1,768	76	7	7.1	30.8	2.0	.02	.0	26	6.2	23	2.4	46	53	32	.2	.7	185	90	53
Sept. 11-20-------	5,189	71	10	7.0	33.8	1.8	.02	.0	29	6.2	26	2.1	50	59	38	.2	.5	191	98	57
Sept. 21-30-------	19,390	64	---	6.9	23.5	5.0	.12	.0	21	4.6	14	2.2	34	41	22	.2	1.0	137	71	43
Average--------	17,070	55	15	6.9	22.6	3.2	0.14	0.0	21	4.7	14	1.6	34	40	23	0.1	0.9	132	72	44

Allegheny River at Kittanning, Pa.

Chemical analyses, in equivalents per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate
Oct. 1-10, 1944	2,952	---	---	---	---	---	---	---	1.697	0.600	1.304	0.056	1.098	0.999	1.467	0.005	0.006	---	---	---
Oct. 11-20	2,433	---	---	---	---	---	---	---	1.597	.559	1.261	.074	.951	1.208	1.297	.000	.006	---	---	---
Oct. 21-31	4,914	---	---	---	---	---	---	---	1.547	.543	1.174	.056	.918	1.083	1.410	.005	.006	---	---	---
Nov. 1-10	2,562	---	---	---	---	---	---	---	1.398	.543	1.044	.051	.754	1.062	1.128	.005	.008	---	---	---
Nov. 11-20	3,904	---	---	---	---	---	---	---	1.647	.600	1.174	.051	.984	1.124	1.297	.005	.005	---	---	---
Nov. 21-30	6,912	---	---	---	---	---	---	---	1.398	.543	.870	.046	.885	.916	1.100	.005	.006	---	---	---
Dec. 1-10	9,611	---	---	---	---	---	---	---	1.198	.419	.696	.038	.688	.791	.846	.011	.010	---	---	---
Dec. 11-20	11,150	---	---	---	---	---	---	---	.998	.354	.522	.038	.459	.791	.592	.011	.019	---	---	---
Dec. 21-31	10,080	---	---	---	---	---	---	---	1.098	.419	.478	.036	.623	.937	.508	.005	.013	---	---	---
Jan. 1-10, 1945	14,950	---	---	---	---	---	---	---	.948	.354	.435	.041	.426	.833	.508	.005	.019	---	---	---
Jan. 11-20	8,741	---	---	---	---	---	---	---	.998	.378	.478	.033	.492	.770	.564	.005	.018	---	---	---
Jan. 21-31	5,920	---	---	---	---	---	---	---	1.148	.444	.565	.028	.557	1.020	.592	.005	.018	---	---	---
Feb. 1-10	4,950	---	---	---	---	---	---	---	1.298	.461	.652	.043	.656	1.062	.733	.000	.019	---	---	---
Feb. 11-20	12,720	---	---	---	---	---	---	---	1.248	.452	.609	.056	.656	.958	.705	.000	.019	---	---	---
Feb. 21-28	62,980	---	---	---	---	---	---	---	.749	.288	.352	.033	.262	.666	.451	.011	.045	---	---	---
Mar. 1-10	87,620	---	---	---	---	---	---	---	.499	.214	.187	.026	.180	.500	.200	.005	.034	---	---	---
Mar. 11-20	51,530	---	---	---	---	---	---	---	.549	.230	.209	.010	.230	.500	.226	.016	.024	---	---	---
Mar. 21-31	67,270	---	---	---	---	---	---	---	.499	.214	.178	.026	.213	.458	.192	.011	.016	---	---	---
Apr. 1-10	47,160	---	---	---	---	---	---	---	.549	.214	.239	.026	.279	.520	.223	.011	.015	---	---	---
Apr. 11-20	16,620	---	---	---	---	---	---	---	.848	.321	.330	.033	.328	.874	.338	.005	.010	---	---	---
Apr. 21-30	20,350	---	---	---	---	---	---	---	.849	.337	.417	.018	.393	.750	.423	.005	.010	---	---	---
May 1-10	30,130	---	---	---	---	---	---	---	.699	.271	.357	.031	.328	.645	.367	.005	.010	---	---	---
May 11-20	33,060	---	---	---	---	---	---	---	.599	.247	.296	.031	.328	.521	.310	.005	.013	---	---	---
May 21-31	15,200	---	---	---	---	---	---	---	.798	.312	.361	.026	.328	.833	.338	.005	.010	---	---	---
June 1-10	14,300	---	---	---	---	---	---	---	.798	.304	.430	.028	.442	.729	.395	.005	.013	---	---	---
June 11-20	16,790	---	---	---	---	---	---	---	.798	.296	.400	.036	.475	.645	.423	.005	.016	---	---	---
June 21-30	10,150	---	---	---	---	---	---	---	.798	.312	0.478		.492	.645	.423	.005	.016	---	---	---
July 1-10	5,253	---	---	---	---	---	---	---	1.048	.370	.652	.041	.606	.791	.649	.011	.006	---	---	---
July 11-20	9,295	---	---	---	---	---	---	---	.998	.370	.696	.041	.623	.770	.677	.011	.013	---	---	---
July 21-31	6,345	---	---	---	---	---	---	---	.848	.312	.609	.036	.459	.687	.592	.005	.013	---	---	---
Aug. 1-10	6,420	---	---	---	---	---	---	---	.948	.354	.609	.046	.524	.833	.620	.005	.011	---	---	---
Aug. 11-20	3,776	---	---	---	---	---	---	---	1.049	.411	.739	.051	.606	.874	.705	.005	.015	---	---	---
Aug. 21-31	2,185	---	---	---	---	---	---	---	1.198	.461	.913	.064	.836	.833	.931	.011	.013	---	---	---
Sept. 1-10	1,768	---	---	---	---	---	---	---	1.297	.510	1.000	.061	.754	1.103	.902	.011	.011	---	---	---
Sept. 11-20	5,189	---	---	---	---	---	---	---	1.447	.510	1.131	.054	.819	1.228	1.072	.011	.010	---	---	---
Sept. 21-30	19,390	---	---	---	---	---	---	---	1.048	.378	.609	.056	.557	.854	.620	.011	.016	---	---	---
Average	17,070	---	---	---	---	---	---	---	1.048	0.387	0.609	0.041	0.557	0.833	0.649	0.005	0.015	---	---	---

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Allegheny River at Kittanning, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																	Total	Noncarbonate
Oct. 1-10, 1945	41,390	56	23	6.7	12.6	5.2	0.03	14	3.4	4.7	23	24	10	0.1	1.2	82	49	30
Oct. 11-20	13,990	53	15	6.8	17.6	5.7	.15	17	3.9	9.8	30	33	12	.1	1.0	104	58	34
Oct. 21-31	19,920	57	12	6.9	18.0	4.5	.04	17	4.1	12	37	31	15	.1	.6	103	59	29
Nov. 1-10	17,910	56	11	6.9	16.7	4.8	.08	16	3.8	10	31	30	14	.1	.6	96	56	30
Nov. 11-20	23,550	54	12	6.9	16.3	4.7	.05	15	5.0	7.1	24	33	13	.1	.9	96	58	38
Nov. 21-30	29,240	48	12	6.8	13.6	4.8	.12	13	3.4	7.3	20	28	11	.2	.8	81	46	30
Dec. 1-10	23,940	41	10	7.0	14.6	4.8	.07	14	3.7	7.5	24	29	11	.1	1.0	84	50	30
Dec. 11-20	11,420	37	14	7.0	16.6	4.1	.13	16	4.0	11	30	34	14	.1	1.2	98	56	32
Dec. 21-31	8,565	36	19	7.1	21.4	4.1	.10	20	4.8	13	33	44	17	.1	1.5	125	70	43
Jan. 1-10, 1946	33,250	36	15	6.8	17.2	4.0	.10	16	3.9	9.8	27	33	14	.0	1.4	100	56	34
Jan. 11-20	29,280	36	12	6.8	12.2	4.0	.10	11	3.0	7.5	18	26	9.2	.1	1.2	73	40	25
Jan. 21-31	6,915	36	8	7.1	19.8	4.2	.18	18	4.8	12	30	41	16	.1	1.3	116	65	40
Feb. 1-10	7,072	36	3	7.0	22.8	4.5	.15	21	5.1	15	37	42	22	.1	1.3	137	73	43
Feb. 11-20	16,240	38	7	6.9	18.9	4.0	.15	18	4.0	12	30	33	19	.1	1.3	113	61	37
Feb. 21-28	16,310	38	16	6.8	17.2	4.7	.14	16	3.0	11	24	33	14	.1	1.9	100	52	33
Mar. 1-10	41,250	41	15	6.7	12.1	4.3	.10	11	2.9	5.4	14	23	10	.1	1.7	72	39	28
Mar. 11-20	30,920	42	7	6.7	12.5	2.5	.10	11	3.1	7.1	18	25	9.5	.1	1.5	75	40	25
Mar. 21-31	15,570	47	12	6.8	15.9	1.8	.10	14	3.7	9.2	22	30	14	.1	.9	93	50	32
Apr. 1-10	7,561	50	17	7.0	19.5	2.4	.20	17	4.5	12	26	36	19	.1	.4	116	61	40
Apr. 11-20	6,295	50	7	7.2	24.8	2.0	.20	22	5.3	18	38	42	29	.1	.2	141	77	46
Apr. 21-30	5,899	53	10	7.0	24.7	.6	.10	20	4.6	21	39	37	31	.1	.2	147	69	37
May 1-10	5,562	55	13	7.0	25.3	1.0	.13	22	5.0	19	39	39	31	.1	.2	147	75	44
May 11-20	15,400	57	15	7.0	21.7	4.1	.11	18	4.3	16	32	34	25	.1	.2	128	63	36
May 21-31	52,870	58	17	7.0	14.4	2.7	.12	13	3.2	9.3	26	23	14	.1	.8	88	46	24
June 1-10	42,030	60	30	7.0	11.4	5.3	.18	11	2.6	8.1	23	21	10	.1	1.0	73	38	19
June 11-20	28,380	62	17	7.0	13.5	5.0	.11	13	3.2	7.6	24	25	11	.1	.8	83	46	26
June 21-30	18,750	64	8	7.2	15.8	4.3	.15	15	3.6	12	31	30	14	.1	.8	96	52	27
July 1-10	10,810	66	7	7.4	18.8	2.6	.03	18	4.1	11	33	31	18	.1	.6	106	62	35
July 11-20	3,899	70	5	7.2	21.6	2.1	.02	18	4.3	17	36	38	21	---	.4	128	63	33
July 21-31	4,553	71	8	7.1	28.2	3.4	.04	25	5.6	20	48	47	29	---	.6	165	85	46
Aug. 1-10	3,468	70	10	7.1	30.2	3.2	.04	26	5.7	23	47	47	36	---	.4	175	88	50
Aug. 11-20	2,942	70	10	7.2	33.1	2.0	.03	24	6.3	30	45	49	44	---	.6	186	86	49
Aug. 21-31	2,339	67	10	6.9	34.3	2.6	.03	29	6.4	29	50	56	43	.1	.6	200	99	58
Sept. 1-10	1,257	65	8	7.0	38.1	2.0	.02	32	6.9	30	52	59	49	.1	.5	220	108	66
Sept. 11-20	1,209	63	7	7.2	43.5	1.4	.02	34	7.5	39	58	62	63	.1	.2	248	116	68
Sept. 21-30	1,282	61	8	7.2	46.5	2.8	.03	38	8.2	40	63	68	66	.1	.2	274	128	77
Average	16,690	53	12	7.0	21.2	3.5	0.10	19	4.5	15	33	37	22	0.1	0.8	124	66	39

Allegheny River at Kittanning, Pa.

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate
Oct. 1-10, 1945	41,390	---	---	---	---	---	---	0.69[illegible]	0.280	0.204	0.377	0.360	0.282	0.005	0.019	---	---	---
Oct. 11-20	13,990	---	---	---	---	---	---	.846	.321	.425	.492	.867	.338	.005	.01[illegible]	---	---	---
Oct. 21-31	19,920	---	---	---	---	---	---	.84[illegible]	.3[illegible]7	.[illegible]04	.[illegible]06	.845	.42[illegible]	.005	.010	---	---	---
Nov. 1-10	17,910	---	---	---	---	---	---	.790	.312	.433	.508	.628	.[illegible]95	.005	.010	---	---	---
Nov. 11-20	23,550	---	---	---	---	---	---	.749	.411	.[illegible]07	.393	.5[illegible]7	.327	.005	.[illegible]12	---	---	---
Nov. 21-30	29,240	---	---	---	---	---	---	.84[illegible]	.280	.316	.328	.563	.310	.011	.013	---	---	---
Dec. 1-10	23,940	---	---	---	---	---	---	.69[illegible]	.304	.[illegible]2[illegible]	.3[illegible]3	.[illegible]0[illegible]	.[illegible]10	.00[illegible]	.01[illegible]	---	---	---
Dec. 11-20	11,420	---	---	---	---	---	---	.798	.[illegible]29	.492	.[illegible]32	.70[illegible]	.[illegible]5[illegible]	.0[illegible]8	.019	---	---	---
Dec. 21-31	8,565	---	---	---	---	---	---	.998	.395	.[illegible]7[illegible]	.641	.9[illegible]	.47[illegible]	.00[illegible]	.024	---	---	---
Jan. 1-10, 1946	33,250	---	---	---	---	---	---	.798	.321	.426	.442	.667	.395	.000	.023	---	---	---
Jan. 11-20	29,280	---	---	---	---	---	---	.549	.247	.[illegible]24	.[illegible]29	.541	.260	.005	.019	---	---	---
Jan. 21-31	6,915	---	---	---	---	---	---	.898	.395	.[illegible]30	.492	.854	.451	.006	.021	---	---	---
Feb. 1-10	7,072	---	---	---	---	---	---	1.048	.419	.659	.[illegible]06	.[illegible]74	.[illegible]20	.005	.021	---	---	---
Feb. 11-20	16,240	---	---	---	---	---	---	.[illegible]98	.329	.514	.492	.5[illegible]7	.[illegible]53	.005	.021	---	---	---
Feb. 21-28	16,310	---	---	---	---	---	---	.798	.247	.4[illegible]	.393	.667	.[illegible]90	.005	.031	---	---	---
Mar. 1-10	41,250	---	---	---	---	---	---	.549	.238	.255	.229	.479	.282	.00[illegible]	.027	---	---	---
Mar. 11-20	30,920	---	---	---	---	---	---	.549	.255	.309	.295	.521	.260	.005	.024	---	---	---
Mar. 21-31	15,570	---	---	---	---	---	---	.699	.304	.348	.361	.625	.395	.005	.015	---	---	---
Apr. 1-10	7,561	---	---	---	---	---	---	.848	.370	.505	.426	.750	.536	.005	.006	---	---	---
Apr. 11-20	6,295	---	---	---	---	---	---	1.098	.436	.789	.623	.874	.818	.005	.003	---	---	---
Apr. 21-30	5,899	---	---	---	---	---	---	.998	.378	.915	.639	.770	.874	.005	.003	---	---	---
May 1-10	5,562	---	---	---	---	---	---	1.098	.411	.824	.639	.812	.874	.001	.003	---	---	---
May 11-20	15,400	---	---	---	---	---	---	.898	.354	.693	.524	.708	.705	.005	.003	---	---	---
May 21-31	52,670	---	---	---	---	---	---	.649	.263	.406	.426	.479	.395	.005	.013	---	---	---
June 1-10	42,030	---	---	---	---	---	---	.549	.214	.354	.377	.437	.282	.005	.010	---	---	---
June 11-20	28,380	---	---	---	---	---	---	.649	.263	.330	.393	.521	.310	.005	.013	---	---	---
June 21-30	16,750	---	---	---	---	---	---	.749	.296	.501	.508	.625	.395	.005	.013	---	---	---
July 1-10	10,810	---	---	---	---	---	---	.898	.337	.474	.541	.645	.508	.005	.010	---	---	---
July 11-20	3,899	---	---	---	---	---	---	.[illegible]98	.354	.727	.590	.791	.592	---	.006	---	---	---
July 21-31	4,553	---	---	---	---	---	---	1.248	.461	.885	.787	.979	.[illegible]18	---	.010	---	---	---
Aug. 1-10	3,468	---	---	---	---	---	---	1.297	.469	1.004	.770	.979	1.015	---	.006	---	---	---
Aug. 11-20	2,042	---	---	---	---	---	---	1.198	.518	1.202	.787	1.020	1.241	---	.010	---	---	---
Aug. 21-31	2,339	---	---	---	---	---	---	1.447	.543	1.240	.819	1.166	1.213	.005	.010	---	---	---
Sept. 1-10	1,257	---	---	---	---	---	---	1.[illegible]7	.567	1.311	.[illegible]02	1.228	1.[illegible]82	.00[illegible]	.008	---	---	---
Sept. 11-20	1,209	---	---	---	---	---	---	1.[illegible]97	.617	1.71[illegible]	.[illegible]51	1.201	1.777	.00[illegible]	.003	---	---	---
Sept. 21-30	1,282	---	---	---	---	---	---	1.[illegible]6	.674	1.[illegible]7[illegible]	1.[illegible]02	1.416	1.861	.00[illegible]	.003	---	---	---
Average	16,690	---	---	---	---	---	---	0.948	0.370	0.631	0.541	0.770[illegible]	0.620	0.005	0.013	---	---	---

MERCE
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Ohio River at South Heights, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$		Total acidity as H_2SO_4
																				Total	Noncarbonate	
Oct. 1-10, 1945	58,700	59	7	6.2	21.9	6.7	---	0.05	0.00	20	5.6	10	2.6	10	70	8.8	0.1	2.1	138	73	65	---
Oct. 11-20	25,870	53	4	6.0	27.3	6.8	---	.02	.00	24	7.2	13	3.0	6	96	10	.1	1.0	177	90	85	---
Oct. 21-31	25,690	53	5	6.3	30.5	6.4	---	.04	.00	27	7.7	16	3.2	14	101	14	.2	1.1	194	99	88	---
Nov. 1-10	28,400	50	3	6.1	30.9	4.8	---	.02	.45	28	7.6	17	3.2	10	106	14	.2	1.3	193	101	93	---
Nov. 11-20	53,800	50	4	5.9	29.6	6.8	---	.02	.50	27	7.6	14	2.3	7	107	9.9	.1	2.1	190	99	93	---
Nov. 21-30	69,050	43	3	5.8	21.5	6.4	---	.08	.40	21	5.8	9.1	2.1	10	77	5.4	.1	2.2	133	76	68	---
Dec. 1-10	53,300	40	3	5.5	22.6	6.2	---	.06	.45	21	6.0	9.7	2.8	5	82	6.3	.2	1.1	141	77	73	---
Dec. 11-20	25,570	35	3	5.7	25.3	4.2	---	.03	.29	22	6.2	15	1.6	5	90	9.5	.1	1.6	157	80	76	---
Dec. 21-31	24,720	34	8	5.0	33.7	5.4	---	.02	.20	29	8.3	20	1.6	4	126	12	.2	1.8	215	106	103	---
Jan. 1-10, 1946	71,370	37	10	5.8	25.3	5.0	---	.02	.45	24	6.8	13	.8	7	92	8.0	.1	2.4	162	88	82	---
Jan. 11-20	58,860	39	8	5.7	19.5	4.4	---	.02	.28	17	4.8	10	1.0	6	70	6.0	.1	2.1	127	62	57	---
Jan. 21-31	15,170	33	9	5.1	29.1	4.8	---	.03	.48	23	7.6	15	2.2	2	107	11	.1	2.0	180	89	87	10
Feb. 1-10	22,630	33	2	4.35	38.5	6.8	1.0	.03	.64	31	10	20	1.9	0	144	13	.2	1.4	245	126	126	12
Feb. 11-20	40,690	35	10	5.7	25.1	4.0	---	.03	.19	22	6.3	14	1.8	5	94	8.6	.1	1.7	158	81	77	---
Feb. 21-28	37,990	37	14	6.2	25.1	4.8	---	.02	.30	22	6.2	14	1.8	8	90	8.6	.1	1.8	157	80	74	---
Mar. 1-10	68,580	41	2	6.0	21.7	4.9	---	.01	.33	19	5.6	9.5	1.6	6	74	7.2	.1	2.2	136	70	66	---
Mar. 11-20	62,940	46	2	6.0	22.6	5.0	---	.02	.39	20	5.9	9.2	1.6	6	80	6.5	.1	2.0	142	74	69	---
Mar. 21-31	39,660	52	1	5.9	27.0	5.0	---	.03	.42	24	7.1	12	1.6	5	99	7.5	.1	1.6	173	89	85	---
Apr. 1-10	23,680	54	1	5.8	28.9	5.0	---	.02	.46	25	7.6	13	1.7	5	105	9.1	.1	1.3	185	94	90	---
Apr. 11-20	14,370	52	2	4.8	36.9	4.6	.6	.02	.40	32	8.2	20	1.8	2	136	15	.2	2.1	229	118	116	12
Apr. 21-30	12,320	56	2	5.0	40.2	4.4	.6	.02	.15	35	9.3	24	1.8	6	149	22	.2	1.3	253	129	124	14
May 1-10	15,990	58	5	4.4	44.2	6.0	2.2	.04	.64	35	11	23	2.5	0	163	17	.2	.9	284	147	147	18
May 11-20	43,370	60	5	5.3	30.8	5.0	---	.04	.25	26	8.0	16	2.2	4	111	13	.2	.8	202	98	94	---
May 21-31	78,280	62	8	6.1	20.4	5.4	---	.07	.20	18	5.3	8.7	1.4	8	67	8.2	.2	1.4	131	67	60	---
June 1-10	83,320	61	5	5.9	20.8	6.2	---	.04	.32	20	5.3	8.6	.8	6	76	5.9	.1	2.2	134	72	67	---
June 11-20	55,050	68	1	5.7	24.5	6.2	---	.03	.51	22	6.6	10	1.4	4	88	8.5	.1	2.1	159	82	79	---
June 21-30	44,110	71	3	6.1	24.3	6.2	---	.03	.41	22	6.6	11	1.7	8	86	8.5	.1	2.1	158	82	76	---
July 1-10	20,130	76	2	6.0	28.8	5.1	---	.02	.41	25	7.3	15	1.7	7	98	15	.2	2.3	182	92	87	---
July 11-20	9,237	80	3	4.7	38.6	6.4	.6	.03	.95	32	9.3	22	1.5	3	146	16	.3	1.3	252	123	121	11
July 21-31	9,363	79	4	4.45	45.1	6.3	1.1	.03	1.2	38	11	24	2.4	0	170	18	.3	1.1	292	149	149	15
Aug. 1-10	9,734	78	6	4.20	50.1	6.4	1.2	.02	1.0	44	12	32		0	192	25	.3	5.0	331	171	171	14
Aug. 11-20	7,253	77	4	4.10	52.8	6.4	1.6	.04	.75	43	11	29	3.5	0	186	27	.3	2.4	325	167	167	18
Aug. 21-31	5,519	74	4	4.10	56.7	7.2	1.4	.06	1.0	46	13	31	4.8	0	202	27	.3	3.1	349	182	182	18
Sept. 1-10	3,002	73	5	4.20	60.2	6.4	1.0	.04	1.0	49	13	39	3.4	0	207	34	.3	4.1	374	186	186	13
Sept. 11-20	3,047	73	5	3.90	70.5	8.0	1.6	.06	1.2	57	14	44	4.2	0	247	38	.7	14	444	217	217	19
Sept. 21-30	3,195	73	7	3.90	85.2	9.2	2.1	.05	1.2	71	18	53	6.2	0	328	36	.8	3.1	554	271	271	24
Average	33,870	55	5	---	34.3	5.8	---	0.03	0.50	29	8.3	18	2.3	---	124	14	0.2	2.3	218	---	---	16

Ohio River at South Heights, Pa.

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
Oct. 1-10, 1945	58,700	---	---	---	---	---	---	---	---	0.998	0.461	0.435	0.067	0.164	1.457	0.248	0.005	0.034	---	---	---	---
Oct. 11-20	25,870	---	---	---	---	---	---	---	---	1.198	.592	.565	.077	.098	1.909	.282	.005	.010	---	---	---	---
Oct. 21-31	25,690	---	---	---	---	---	---	---	---	1.347	.633	.696	.082	.229	2.103	.305	.011	.018	---	---	---	---
Nov. 1-10	28,400	---	---	---	---	---	---	---	---	1.397	.625	.739	.082	.164	2.207	.395	.011	.021	---	---	---	---
Nov. 11-20	53,800	---	---	---	---	---	---	---	---	1.347	.625	.609	.059	.115	2.228	.279	.005	.034	---	---	---	---
Nov. 21-30	69,050	---	---	---	---	---	---	---	---	1.048	.477	.396	.054	.164	1.603	.152	.005	.030	---	---	---	---
Dec. 1-10	53,300	---	---	---	---	---	---	---	---	1.048	.493	.422	.072	.082	1.707	.178	.011	.018	---	---	---	---
Dec. 11-20	25,570	---	---	---	---	---	---	---	---	1.098	.510	.652	.041	.082	1.874	.268	.005	.023	---	---	---	---
Dec. 21-31	24,720	---	---	---	---	---	---	---	---	1.447	.693	.870	.041	.066	2.623	.338	.011	.029	---	---	---	---
Jan. 1-10, 1946	71,370	---	---	---	---	---	---	---	---	1.198	.559	.565	.020	.115	1.915	.226	.005	.039	---	---	---	---
Jan. 11-20	84,860	---	---	---	---	---	---	---	---	.848	.395	.435	.026	.098	1.457	.169	.005	.034	---	---	---	---
Jan. 21-31	15,170	---	---	---	---	---	---	---	---	1.148	.625	.652	.056	.033	2.228	.310	.005	.032	---	---	---	---
Feb. 1-10	22,630	---	---	---	---	---	0.111	0.002	0.023	1.547	.822	.870	.049	.000	2.998	.367	.011	.023	---	---	---	---
Feb. 11-20	40,800	---	---	---	---	---	---	---	---	1.098	.518	.609	.046	.082	1.957	.242	.005	.027	---	---	---	---
Feb. 21-28	37,990	---	---	---	---	---	---	---	---	1.098	.510	.609	.046	.131	1.874	.242	.005	.029	---	---	---	---
Mar. 1-10	66,500	---	---	---	---	---	---	---	---	.948	.461	.413	.041	.008	1.541	.203	.005	.035	---	---	---	---
Mar. 11-20	62,940	---	---	---	---	---	---	---	---	.998	.485	.400	.041	.098	1.666	.183	.005	.032	---	---	---	---
Mar. 21-31	39,600	---	---	---	---	---	---	---	---	1.198	.584	.522	.041	.082	2.061	.212	.005	.026	---	---	---	---
Apr. 1-10	23,800	---	---	---	---	---	---	---	---	1.248	.625	.565	.043	.082	2.126	.257	.005	.021	---	---	---	---
Apr. 11-20	14,370	---	---	---	---	---	.067	.001	.015	1.597	.674	.870	.046	.033	2.832	.423	.011	.034	---	---	---	---
Apr. 21-30	12,320	---	---	---	---	---	.067	.001	.005	1.747	.765	1.044	.046	.098	3.102	.620	.011	.021	---	---	---	---
May 1-10	15,960	---	---	---	---	---	.245	.002	.023	1.747	.905	1.000	.064	.000	3.394	.479	.011	.015	---	---	---	---
May 11-20	43,370	---	---	---	---	---	---	---	---	1.297	.658	.696	.056	.066	2.311	.367	.011	.013	---	---	---	---
May 21-31	73,280	---	---	---	---	---	---	---	---	.898	.436	.378	.036	.131	1.395	.231	.011	.023	---	---	---	---
June 1-10	83,320	---	---	---	---	---	---	---	---	.998	.436	.374	.020	.098	1.582	.186	.005	.036	---	---	---	---
June 11-20	55,050	---	---	---	---	---	---	---	---	1.098	.543	.435	.036	.066	1.832	.240	.005	.034	---	---	---	---
June 21-30	44,110	---	---	---	---	---	---	---	---	1.098	.543	.478	.043	.131	1.791	.240	.005	.034	---	---	---	---
July 1-10	20,130	---	---	---	---	---	---	---	---	1.248	.600	.652	.043	.115	2.040	.423	.011	.037	---	---	---	---
July 11-20	9,237	---	---	---	---	---	.067	.002	.035	1.597	.765	.957	.038	.049	3.040	.451	.015	.021	---	---	---	---
July 21-31	9,363	---	---	---	---	---	.122	.002	.044	1.896	.905	1.044	.061	.000	3.539	.508	.016	.018	---	---	---	---
Aug. 1-10	9,734	---	---	---	---	---	.133	.001	.036	2.196	.987	1.385		.000	3.997	.705	.016	.081	---	---	---	---
Aug. 11-20	7,253	---	---	---	---	---	.178	.002	.027	2.146	.905	1.261	.090	.000	3.873	.761	.016	.039	---	---	---	---
Aug. 21-31	5,519	---	---	---	---	---	.156	.003	.036	2.295	1.069	1.348	.123	.000	4.206	.761	.016	.050	---	---	---	---
Sept. 1-10	3,002	---	---	---	---	---	.111	.002	.036	2.445	1.069	1.696	.087	.000	4.310	.959	.016	.066	---	---	---	---
Sept. 11-20	3,047	---	---	---	---	---	.178	.003	.044	2.844	1.151	1.913	.107	.000	5.143	1.072	.037	.226	---	---	---	---
Sept. 21-30	3,195	---	---	---	---	---	.234	.005	.044	3.543	1.480	2.305	.159	.000	6.829	1.015	.042	.050	---	---	---	---
Average	33,670	---	---	---	---	---	---	0.002	0.018	1.447	0.683	0.783	0.059	0.082	2.582	0.395	0.011	0.037	---	---	---	---

P 88.42
2.10

MERCE
ROCEDURES
a State Librar

Ohio River at Ambridge, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Total acidity as H_2SO_4
Oct. 1-10, 1945---	58,700	58	16	6.6	16.8	6.5	---	0.06	0.00	15	4.0	8.0	2.6	16	45	8.0	0.2	1.4	107	54	41	---
Oct. 1-20---------	25,870	55	3	6.2	25.3	6.8	---	.02	.30	23	6.3	12	3.2	6	88	9.8	.1	1.2	163	83	78	---
Oct. 21-31--------	25,690	54	8	6.3	26.6	5.8	---	.05	.25	24	6.4	14	3.3	16	82	14	.1	1.7	167	86	73	---
Nov. 1-10---------	28,400	51	2	6.2	26.8	5.2	---	.02	.20	24	6.3	15	2.7	14	82	14	.1	1.7	163	86	74	---
Nov. 11-20--------	53,800	50	4	6.2	23.1	6.4	---	.03	.08	21	5.9	11	2.6	12	70	11	.2	2.2	142	77	67	---
Nov. 21-30--------	69,050	41	8	6.2	17.3	6.0	---	.03	.13	15	4.3	7.0	1.5	10	49	9.8	.2	1.8	104	55	47	---
Dec. 1-10---------	53,300	39	6	6.1	18.6	5.6	---	.05	.19	16	4.6	8.2	1.6	11	51	10	.1	1.9	110	59	50	---
Dec. 11-20--------	25,570	35	7	6.0	22.7	4.4	---	.02	.40	20	5.6	14	.9	10	72	12	.1	2.2	140	73	65	---
Dec. 21-31--------	24,720	34	9	5.4	31.3	5.0	---	.02	.08	28	7.6	18	1.4	4	114	13	.1	2.0	196	101	98	---
Jan. 1-10, 1946---	71,370	36	11	6.3	22.4	4.8	---	.05	.05	21	5.6	13	1.1	14	66	13	.1	2.0	135	75	64	---
Jan. 11-20--------	58,860	37	10	6.3	15.6	4.4	---	.07	.05	14	3.7	8.1	1.1	10	45	8.2	.1	1.6	100	50	42	---
Jan. 21-31--------	15,170	33	10	5.4	28.1	3.8	---	.03	.35	24	7.1	14	2.2	2	102	11	.1	2.0	176	89	87	---
Feb. 1-10---------	22,630	34	2	4.6	36.8	6.6	1.0	.03	.54	30	9.7	20	1.6	2	137	14	.2	1.4	233	121	113	10
Feb. 11-20--------	40,690	34	15	6.3	25.3	4.6	---	.03	.21	23	6.2	15	2.4	14	78	16	.1	2.6	156	83	71	---
Feb. 21-28--------	37,990	36	18	6.3	22.1	4.6	---	.03	.20	20	5.3	12	2.1	10	69	12	.1	2.7	136	72	64	---
Mar. 1-10---------	68,580	30	15	6.4	15.4	4.4	---	.17	.05	14	3.6	7.7	1.8	12	41	10	.1	2.2	95	50	40	---
Mar. 11-20--------	62,940	46	16	6.5	15.6	4.7	---	.18	.21	14	3.8	7.9	1.6	11	44	9.2	.1	1.6	97	51	42	---
Mar. 21-31--------	39,660	54	2	6.3	21.3	5.1	---	.03	.39	19	5.3	9.8	1.8	9	65	11	.1	1.8	130	69	63	---
Apr. 1-10---------	23,680	54	1	6.1	26.2	4.9	---	.03	.52	23	6.6	12	3.1	7	88	11	.1	1.3	163	85	79	---
Apr. 11-20--------	14,370	54	3	5.4	34.8	5.6	---	.06	---	30	8.5	19	2.0	3	126	17	.2	.3	217	109	107	---
Apr. 21-30--------	12,320	58	3	5.0	40.1	4.6	.4	.02	.55	37	9.0	23	1.8	5	144	21	.2	2.1	252	133	128	11
May 1-10----------	15,990	59	6	4.7	42.7	6.0	1.9	.04	.62	34	10	24	2.4	1	159	18	.3	.7	279	138	137	---
May 11-20---------	43,370	61	9	5.9	30.4	4.6	---	.13	.52	26	6.6	17	1.0	7	96	19	.1	1.6	186	92	86	---
May 21-31---------	78,220	63	15	6.3	14.9	5.2	---	.12	.05	13	3.2	7.6	.5	13	37	10	.1	2.0	89	46	35	---
June 1-10---------	83,320	61	15	6.4	14.8	5.7	---	.14	.06	14	3.6	5.5	.9	11	40	8.0	.1	2.2	91	50	41	---
June 11-20--------	55,050	68	7	6.2	19.8	5.8	---	.08	.39	18	4.9	7.7	.8	8	63	8.8	.1	1.6	124	65	58	---
June 21-30--------	44,110	71	4	6.2	21.6	6.0	---	.03	.24	20	5.6	9.0	1.4	10	73	8.0	.1	2.3	139	73	65	---
July 1-10---------	20,130	77	1	5.9	27.5	4.9	---	.02	.42	24	6.6	14	1.4	8	94	13	.2	2.1	173	87	80	---
July 11-20--------	9,237	80	1	5.2	38.0	6.5	---	.03	.91	32	9.1	22	1.8	4	142	16	.3	.9	247	117	114	---
July 21-31--------	9,363	80	1	4.7	43.8	6.7	1.0	.02	1.2	37	11	23	2.2	2	167	18	.3	.9	287	145	144	14
Aug. 1-10---------	9,734	---	5	4.7	50.4	7.2	1.1	.06	.30	44	12	32	---	0	189	24	.3	4.7	332	166	166	17
Aug. 11-20--------	7,253	76	8	4.2	52.8	6.0	1.4	.04	.72	43	12	29	6.1	0	187	26	.3	2.7	326	169	169	17
Aug. 21-31--------	5,519	75	6	4.1	56.3	6.8	1.4	.05	.91	46	13	32	4.8	0	205	28	.3	8.2	350	182	182	19
Sept. 1-10--------	3,002	73	6	4.1	59.9	7.2	1.4	.04	1.1	48	12	38	5.1	0	207	33	.3	4.8	374	183	183	14
Sept. 11-20-------	3,047	73	7	4.0	69.5	7.6	1.2	.04	1.2	56	14	44	6.4	0	244	37	.4	6.0	430	211	211	18
Sept. 21-30-------	3,195	73	6	4.2	80.9	10	2.1	.03	.95	70	18	53	7.2	0	320	36	.9	2.7	544	265	265	19
Average-------	33,870	55	.7	5.6	31.5	5.7	---	0.05	0.41	27	7.4	17	2.4	---	108	15	0.2	2.3	199	102	---	---

Ohio River at Ambridge, Pa.

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
Oct. 1-10, 1945	58,700	---	---	---	---	---	---	---	---	0.749	0.329	0.348	0.067	0.262	0.937	0.226	0.011	0.023	---	---	---	---
Oct. 11-20	25,870	---	---	---	---	---	---	---	---	1.148	.518	.522	.082	.098	1.832	.276	.005	.019	---	---	---	---
Oct. 21-31	25,690	---	---	---	---	---	---	---	---	1.198	.526	.600	.084	.262	1.707	.395	.005	.027	---	---	---	---
Nov. 1-10	28,400	---	---	---	---	---	---	---	---	1.198	.518	.652	.069	.229	1.707	.395	.005	.027	---	---	---	---
Nov. 11-20	53,800	---	---	---	---	---	---	---	---	1.048	.485	.478	.067	.197	1.457	.310	.011	.036	---	---	---	---
Nov. 21-30	69,050	---	---	---	---	---	---	---	---	.749	.354	.304	.038	.164	1.020	.276	.011	.029	---	---	---	---
Dec. 1-10	53,300	---	---	---	---	---	---	---	---	.798	.378	.357	.041	.180	1.062	.282	.005	.031	---	---	---	---
Dec. 11-20	25,570	---	---	---	---	---	---	---	---	.998	.461	.609	.023	.164	1.499	.338	.005	.036	---	---	---	---
Dec. 21-31	24,720	---	---	---	---	---	---	---	---	1.397	.625	.783	.036	.066	2.374	.367	.005	.032	---	---	---	---
Jan. 1-10, 1946	71,370	---	---	---	---	---	---	---	---	1.048	.461	.565	.028	.229	1.374	.367	.005	.032	---	---	---	---
Jan. 11-20	58,660	---	---	---	---	---	---	---	---	.649	.304	.352	.028	.164	.937	.231	.005	.026	---	---	---	---
Jan. 21-31	15,170	---	---	---	---	---	---	---	---	1.198	.584	.609	.056	.033	2.124	.310	.005	.032	---	---	---	---
Feb. 1-10	22,630	---	---	---	---	---	0.111	0.002	0.020	1.497	.798	.870	.041	.033	2.852	.395	.011	.023	---	---	---	---
Feb. 11-20	40,690	---	---	---	---	---	---	---	---	1.148	.510	.652	.061	.229	1.824	.451	.005	.042	---	---	---	---
Feb. 21-28	37,990	---	---	---	---	---	---	---	---	.998	.436	.522	.054	.164	1.437	.338	.005	.044	---	---	---	---
Mar. 1-10	68,580	---	---	---	---	---	---	---	---	.649	.296	.333	.046	.197	.854	.282	.005	.036	---	---	---	---
Mar. 11-20	62,940	---	---	---	---	---	---	---	---	.699	.312	.344	.041	.180	.916	.260	.005	.026	---	---	---	---
Mar. 21-31	33,660	---	---	---	---	---	---	---	---	.548	.436	.426	.046	.147	1.353	.310	.005	.029	---	---	---	---
Apr. 1-10	23,680	---	---	---	---	---	---	---	---	1.148	.543	.522	.079	.115	1.832	.310	.005	.021	---	---	---	---
Apr. 11-20	14,370	---	---	---	---	---	---	---	---	1.497	.699	.826	.051	.049	2.623	.479	.011	.005	---	---	---	---
Apr. 21-30	12,320	---	---	---	---	---	.044	.001	.020	1.846	.740	1.000	.046	.082	2.908	.592	.011	.034	---	---	---	---
May 1-10	15,990	---	---	---	---	---	.211	.002	.023	1.697	.822	1.044	.061	.016	3.310	.508	.016	.011	---	---	---	---
May 11-20	43,370	---	---	---	---	---	---	---	---	1.297	.543	.739	.026	.115	1.909	.536	.005	.026	---	---	---	---
May 21-31	78,280	---	---	---	---	---	---	---	---	.649	.263	.330	.013	.213	.770	.282	.005	.032	---	---	---	---
June 1-10	83,320	---	---	---	---	---	---	---	---	.699	.296	.239	.023	.180	.633	.226	.005	.036	---	---	---	---
June 11-20	55,050	---	---	---	---	---	---	---	---	.898	.403	.335	.020	.131	1.312	.248	.005	.026	---	---	---	---
June 21-30	44,110	---	---	---	---	---	---	---	---	.998	.461	.391	.036	.164	1.520	.226	.005	.037	---	---	---	---
July 1-10	20,130	---	---	---	---	---	---	---	---	1.198	.543	.609	.036	.131	1.957	.367	.011	.034	---	---	---	---
July 11-20	9,237	---	---	---	---	---	---	---	---	1.547	.748	.957	.046	.066	2.956	.451	.016	.018	---	---	---	---
July 21-31	9,363	---	---	---	---	---	.111	.001	.044	1.846	.905	1.000	.056	.033	3.477	.508	.016	.015	---	---	---	---
Aug. 1-10	9,734	---	---	---	---	---	.122	.003	.011	2.190	.987	1.385		.000	3.935	.677	.016	.076	---	---	---	---
Aug. 11-20	7,253	---	---	---	---	---	.156	.002	.026	2.140	.987	1.261	.156	.000	3.893	.733	.016	.044	---	---	---	---
Aug. 21-31	5,519	---	---	---	---	---	.156	.003	.033	2.295	1.069	1.391	.123	.000	4.268	.790	.016	.132	---	---	---	---
Sept. 1-10	3,002	---	---	---	---	---	.156	.002	.040	2.395	.987	1.652	.130	.000	4.310	.931	.016	.077	---	---	---	---
Sept. 11-20	3,047	---	---	---	---	---	.133	.002	.044	2.794	1.151	1.913	.164	.000	5.080	1.044	.021	.097	---	---	---	---
Sept. 21-30	3,195	---	---	---	---	---	.234	.002	.035	3.493	1.480	2.305	.184	.000	6.662	1.015	.042	.044	---	---	---	---
Average	33,670	---	---	---	---	---	---	---	---	1.347	0.609	0.739	0.061	---	2.249	0.423	0.011	0.037	---	---	---	---

P 38.42
2.10

MERCE
ROCEDUR
a State Libra

Monongahela River at Charleroi, Pa.

Chemical analyses, in parts per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
Oct. 1-10, 1944	5,961	66	5	3.5	54.1	7.0	4.6	0.11	1.2	34	11	29	4.3	0	217	8.5	0.2	0.6	342	166	166	46
Oct. 11-20	3,370	60	5	4.0	36.1	6.0	1.1	.15	.7	26	7.9	17	2.9	0	141	5.6	.1	.8	211	110	110	24
Oct. 21-31	14,240	52	3	4.3	22.8	4.8	1.0	.01	.6	18	5.5	8.5	2.7	0	88	4.0	.1	1.9	136	76	76	21
Nov. 1-10	2,235	51	5	4.3	31.8	5.0	2.2	.03	.6	22	7.4	16	1.9	0	120	4.2	.1	1.0	187	101	101	20
Nov. 11-20	2,845	48	5	3.7	42.4	5.8	4.0	.05	.8	26	9.5	19	1.8	0	158	4.9	.2	.8	235	138	138	39
Nov. 21-30	8,391	44	5	3.8	38.3	5.6	3.2	.05	.8	25	8.3	16	1.7	0	143	4.6	.2	.6	210	124	124	29
Dec. 1-10	10,320	38	6	4.8	20.7	4.4	.6	.03	.3	17	5.1	9.7	1.5	1	79	3.9	.1	1.0	126	67	67	8
Dec. 11-20	9,739	33	5	5.1	18.9	5.6	.8	.04	.4	17	5.7	9.6	1.6	6	73	3.0	.2	.9	123	71	66	5
Dec. 21-31	33,520	35	2	4.40	20.1	5.6	1.1	.03	.2	16	5.1	8.5	1.6	0	76	3.4	.1	2.2	124	68	68	15
Jan. 1-10, 1945	33,970	36	3	4.10	19.6	5.0	1.7	.03	.2	14	4.8	6.1	1.2	0	72	1.9	.0	2.0	112	69	69	21
Jan. 11-20	12,940	34	4	3.75	30.8	6.2	3.2	.09	.1	21	7.2	11	1.2	0	114	2.5	.1	1.9	174	109	109	32
Jan. 21-31	7,409	33	4	3.55	39.3	6.8	3.4	.11	.6	24	9.2	15	1.2	0	144	3.0	.1	2.0	208	134	134	43
Feb. 1-10	6,608	32	2	3.50	46.1	6.2	3.7	.11	.6	28	9.7	13	2.3	0	162	4.2	.4	1.8	240	148	148	47
Feb. 11-20	22,930	37	2	4.20	20.0	4.9	.8	.02	.3	16	4.8	6.8	1.0	0	72	2.8	.4	2.8	115	68	68	13
Feb. 21-28	36,300	40	2	4.35	18.3	4.5	.7	.03	.2	16	4.9	5.4	.8	0	65	2.2	.3	2.6	108	66	66	11
Mar. 1-10	53,850	44	2	4.35	18.1	4.5	1.2	.02	.3	16	4.5	4.7	1.2	0	67	2.0	.3	1.9	107	68	68	11
Mar. 11-20	15,250	48	3	3.65	33.8	5.2	3.3	.06	.5	21	7.1	10	1.0	0	117	3.8	.4	1.4	174	114	114	36
Mar. 21-31	18,990	51	2	3.90	28.5	5.6	2.3	.04	.4	20	6.4	11	.8	0	102	6.0	.3	1.2	161	96	96	24
Apr. 1-10	10,310	56	6	3.80	35.1	5.2	2.1	.03	.4	22	8.0	11	1.8	0	121	4.0	.2	1.6	190	108	108	36
Apr. 11-20	8,004	59	6	3.80	40.9	5.4	2.3	.03	.5	28	9.4	14	1.9	0	150	4.8	.2	1.4	234	130	130	39
Apr. 21-30	8,897	59	6	4.00	33.6	5.0	2.4	.02	.3	24	7.9	13	1.6	0	126	3.8	.2	1.0	200	111	111	25
May 1-10	8,164	57	6	3.90	38.2	5.6	2.6	.02	.3	24	8.7	18	1.8	0	134	12	.2	.8	220	117	117	32
May 11-20	19,420	59	4	4.8	20.6	5.0	1.2	.02	.3	17	5.2	7.9	1.4	2	75	4.0	.2	1.2	124	71	69	6
May 21-31	6,809	64	7	3.9	34.6	5.0	2.2	.05	.3	22	7.6	15	1.6	0	122	5.8	.1	1.0	194	105	105	28
June 1-10	4,099	64	3	3.6	43.4	4.4	3.6	.05	.8	26	10	18	1.8	0	153	6.1	.2	1.8	227	140	140	38
June 11-20	9,796	69	3	3.8	36.2	5.4	2.3	.04	.8	24	8.7	13	1.8	0	126	3.9	.2	2.1	194	118	118	27
June 21-30	4,101	74	2	3.9	36.6	5.2	2.4	.05	.4	24	8.7	16	1.8	0	134	4.5	.2	1.0	204	116	116	28
July 1-10	1,834	78	4	3.5	57.4	6.4	4.3	.26	.9	33	13	25	1.9	0	211	7.1	.1	.8	316	178	178	51
July 11-20	1,513	76	4	3.4	69.2	6.4	5.5	.35	1.0	40	14	33	2.7	0	260	8.5	.3	.8	389	212	212	61
July 21-31	3,492	78	3	3.3	77.3	6.4	7.2	.29	1.0	40	15	32	3.0	0	280	7.5	.3	1.0	404	231	231	82
Aug. 1-10	6,684	77	2	3.7	43.1	5.8	2.6	.10	.8	28	9.4	20	1.7	0	157	6.0	.4	1.0	239	135	135	29
Aug. 11-20	1,738	76	7	3.7	40.3	2.8	1.8	.11	.5	25	8.5	17	2.4	0	141	5.0	.2	1.0	215	119	119	32
Aug. 21-31	6,226	74	6	3.9	43.2	4.4	1.4	.07	.7	27	8.9	20	2.5	0	145	7.6	.2	1.4	232	119	119	32
Sept. 1-10	4,125	74	6	3.9	32.1	4.8	.8	.09	.4	20	6.0	15	2.2	0	104	10	.1	.9	171	86	86	24
Sept. 11-20	14,910	70	7	3.9	32.7	5.2	1.6	.12	.6	24	7.3	12	2.1	0	118	4.8	.1	.9	185	106	106	22
Sept. 21-30	20,860	65	6	5.7	18.7	5.8	.4	.02	.2	19	5.0	5.4	1.8	3	75	2.8	.1	1.4	117	71	68	—
Average	12,100	56	4	3.95	35.4	5.4	2.4	0.08	0.5	23	7.9	14	1.8	0	129	5.0	0.2	1.3	199	109	109	30

Monongahela River at Charleroi, Pa.

Chemical analyses, in equivalents per million, water year October 1944 to September 1945

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$		Total acidity as H_2SO_4
																				Total	Non-carbonate	
Oct. 1-10, 1944	5,961	---	---	---	---	---	0.512	0.005	0.044	1.697	0.905	1.261	0.110	0.000	4.518	0.240	0.011	0.010	---	---	---	---
Oct. 11-20	3,370	---	---	---	---	---	.122	.008	.026	1.298	.650	.739	.074	.000	2.936	.158	.005	.013	---	---	---	---
Oct. 21-31	14,240	---	---	---	---	---	.111	.000	.022	.898	.452	.370	.069	.000	1.832	.113	.005	.031	---	---	---	---
Nov. 1-10	2,235	---	---	---	---	---	.245	.002	.022	1.098	.609	.696	.049	.000	2.498	.118	.005	.016	---	---	---	---
Nov. 11-20	2,845	---	---	---	---	---	.445	.003	.029	1.298	.781	.826	.046	.000	3.290	.138	.011	.013	---	---	---	---
Nov. 21-30	8,391	---	---	---	---	---	.356	.003	.029	1.248	.683	.696	.043	.000	2.977	.130	.011	.010	---	---	---	---
Dec. 1-10	10,320	---	---	---	---	---	.067	.003	.011	.848	.419	.422	.038	.016	1.645	.110	.005	.016	---	---	---	---
Dec. 11-20	9,739	---	---	---	---	---	.089	.002	.015	.848	.469	.417	.041	.098	1.520	.085	.011	.015	---	---	---	---
Dec. 21-31	33,520	---	---	---	---	---	.122	.002	.007	.799	.419	.370	.041	.000	1.582	.096	.005	.035	---	---	---	---
Jan. 1-10, 1945	33,970	---	---	---	---	---	.189	.002	.007	.699	.395	.265	.031	.000	1.499	.054	.000	.032	---	---	---	---
Jan. 11-20	12,940	---	---	---	---	---	.356	.005	.004	1.048	.592	.478	.031	.000	2.373	.071	.005	.031	---	---	---	---
Jan. 21-31	7,409	---	---	---	---	---	.378	.006	.022	1.198	.757	.652	.031	.000	2.998	.085	.005	.032	---	---	---	---
Feb. 1-10	6,608	---	---	---	---	---	.412	.006	.022	1.398	.798	.565	.059	.000	3.373	.118	.021	.029	---	---	---	---
Feb. 11-20	22,930	---	---	---	---	---	.089	.001	.011	.799	.395	.296	.026	.000	1.499	.079	.021	.045	---	---	---	---
Feb. 21-28	36,300	---	---	---	---	---	.078	.002	.007	.799	.403	.235	.020	.000	1.353	.062	.016	.042	---	---	---	---
Mar. 1-10	53,850	---	---	---	---	---	.134	.001	.011	.799	.370	.204	.031	.000	1.395	.056	.016	.031	---	---	---	---
Mar. 11-20	15,250	---	---	---	---	---	.367	.003	.020	1.048	.584	.435	.026	.000	2.436	.107	.021	.023	---	---	---	---
Mar. 21-31	18,990	---	---	---	---	---	.256	.002	.015	.998	.526	.478	.020	.000	2.124	.169	.016	.019	---	---	---	---
Apr. 1-10	10,310	---	---	---	---	---	.234	.002	.015	1.098	.658	.478	.046	.000	2.519	.113	.011	.026	---	---	---	---
Apr. 11-20	8,004	---	---	---	---	---	.256	.002	.018	1.397	.773	.609	.049	.000	3.123	.135	.011	.023	---	---	---	---
Apr. 21-30	8,897	---	---	---	---	---	.267	.001	.011	1.198	.650	.565	.041	.000	2.623	.107	.011	.016	---	---	---	---
May 1-10	8,164	---	---	---	---	---	.289	.001	.011	1.198	.716	.783	.046	.000	2.790	.338	.011	.013	---	---	---	---
May 11-20	19,420	---	---	---	---	---	.133	.001	.011	.848	.428	.344	.036	.033	1.562	.113	.011	.019	---	---	---	---
May 21-31	6,809	---	---	---	---	---	.245	.003	.011	1.098	.625	.652	.041	.000	2.540	.164	.005	.016	---	---	---	---
June 1-10	4,099	---	---	---	---	---	.400	.002	.029	1.297	.822	.783	.046	.000	3.186	.172	.011	.029	---	---	---	---
June 11-20	9,796	---	---	---	---	---	.256	.001	.029	1.198	.716	.565	.046	.000	2.623	.111	.011	.034	---	---	---	---
June 21-30	4,101	---	---	---	---	---	.267	.002	.015	1.198	.716	.696	.046	.000	2.790	.127	.011	.016	---	---	---	---
July 1-10	1,834	---	---	---	---	---	.478	.009	.033	1.647	1.069	1.087	.049	.000	4.393	.200	.005	.013	---	---	---	---
July 11-20	1,513	---	---	---	---	---	.612	.013	.036	1.996	1.151	1.435	.069	.000	5.443	.240	.016	.013	---	---	---	---
July 21-31	3,492	---	---	---	---	---	.801	.010	.036	1.996	1.234	1.391	.077	.000	5.830	.212	.016	.016	---	---	---	---
Aug. 1-10	6,684	---	---	---	---	---	.289	.004	.029	1.397	.773	.870	.044	.000	3.269	.169	.021	.016	---	---	---	---
Aug. 11-20	1,738	---	---	---	---	---	.200	.005	.018	1.248	.699	.739	.061	.000	2.936	.141	.011	.016	---	---	---	---
Aug. 21-31	6,226	---	---	---	---	---	.156	.004	.025	1.347	.732	.870	.064	.000	3.019	.214	.011	.023	---	---	---	---
Sept. 1-10	4,125	---	---	---	---	---	.089	.005	.015	.998	.493	.652	.056	.000	2.165	.282	.005	.014	---	---	---	---
Sept. 11-20	14,910	---	---	---	---	---	.178	.006	.022	1.198	.600	.522	.054	.000	2.457	.135	.005	.014	---	---	---	---
Sept. 21-30	20,860	---	---	---	---	---	.044	.001	.007	.948	.411	.235	.046	.049	1.562	.079	.005	.023	---	---	---	---
Average	12,100	---	---	---	---	---	0.267	0.004	0.018	1.149	0.650	0.609	0.046	0.000	2.686	0.141	0.011	0.021	---	---	---	---

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Monongahela River at Charleroi, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
Oct. 1-10, 1945---	5,523	61	3	4.4	32.3	6.0	2.3	0.03	0.50	26	8.6	12	2.8	0	127	4.0	0.2	1.0	206	115	115	21
Oct. 11-20--------	5,047	56	1	3.8	43.0	6.2	3.2	.09	.50	29	9.7	16	3.0	0	161	5.0	.2	.8	248	139	139	37
Oct. 21-31--------	2,025	55	3	3.75	53.3	5.8	3.6	.20	.45	35	13	24	3.3	0	206	7.0	.2	.7	319	171	171	39
Nov. 1-10---------	4,585	53	1	3.7	50.6	6.0	3.9	.21	.30	30	11	22	3.2	0	186	8.0	.2	.7	289	155	153	42
Nov. 11-20--------	15,520	49	1	4.4	30.1	4.4	1.3	.05	.30	24	7.6	13	3.4	0	116	6.0	.1	1.0	190	100	100	14
Nov. 21-30--------	21,360	43	5	4.6	16.3	4.7	.6	.03	.08	14	4.4	6.7	2.2	1	60	2.9	.1	1.9	100	57	56	8
Dec. 1-10---------	17,030	39	2	4.45	19.6	5.2	.6	.05	.25	16	4.9	8.1	2.2	0	72	2.5	.2	1.6	122	65	65	14
Dec. 11-20--------	7,419	34	3	4.2	24.4	4.8	1.2	.03	.30	18	6.0	11	2.3	0	91	3.9	.2	1.7	146	80	80	20
Dec. 21-31--------	9,551	33	3	4.05	32.0	5.2	2.0	.06	.35	23	9.1	15	2.1	0	120	5.1	.2	1.8	192	111	111	25
Jan. 1-10, 1946---	20,450	36	2	4.5	20.3	4.7	.7	.04	.15	17	5.2	7.3	1.6	1	73	3.2	.1	1.8	126	68	67	13
Jan.11-20---------	13,310	40	9	4.5	20.9	3.6	1.2	.04	.30	17	5.3	6.5	1.6	0	79	2.0	.1	1.8	124	72	72	14
Jan. 21-31--------	3,135	36	5	3.9	39.0	6.0	2.9	.06	.39	28	8.6	16	1.8	0	148	4.6	.1	1.9	219	123	123	32
Feb. 1-10---------	9,423	35	4	3.8	43.3	5.4	3.2	.10	.58	28	8.9	17	1.8	0	160	4.4	.1	1.7	235	134	134	38
Feb. 11-20--------	17,030	36	5	4.6	17.0	4.0	.5	.03	.25	14	4.0	6.7	1.2	1	65	2.8	.1	1.9	99	55	54	9
Feb. 21-28--------	11,760	36	3	4.6	20.7	5.1	.2	.04	.00	18	4.9	8.4	.8	1	78	3.0	.1	2.0	128	66	65	8
Mar. 1-10---------	11,440	41	3	4.3	23.4	5.3	.6	.02	.11	18	5.4	9.2	.9	0	89	2.2	.1	1.6	143	73	73	12
Mar. 11-20--------	13,700	46	4	4.8	21.8	5.3	.3	.03	.18	19	5.5	8.8	1.2	3	84	3.2	.1	1.6	138	72	70	10
Mar. 21-31--------	12,200	51	6	4.5	23.9	5.7	.7	.03	.28	20	5.9	9.2	.9	0	94	3.2	.1	1.4	148	79	79	11
Apr. 1-10---------	8,122	52	5	4.7	25.7	5.8	.4	.03	.35	22	6.6	11	1.1	2	104	3.2	.1	1.2	168	85	83	14
Apr. 11-20--------	3,444	52	3	4.0	39.3	5.2	2.2	.04	.40	31	9.1	18	1.5	0	155	9.2	.1	1.3	241	133	133	28
Apr. 21-30--------	2,793	55	3	3.8	47.9	6.4	3.3	.04	.55	34	10	22	1.4	0	191	5.5	.2	1.2	285	154	154	39
May 1-10----------	6,592	56	2	3.7	43.8	6.0	3.0	.07	.40	29	8.0	16	2.8	0	162	4.6	.1	.9	232	133	133	39
May 11-20---------	17,210	58	2	4.15	30.9	5.0	1.3	.22	.25	25	6.5	13	1.6	0	116	5.2	.1	1.1	183	100	100	18
May 21-31---------	11,160	63	1	4.3	23.1	5.6	1.2	.03	.25	18	5.6	8.2	1.2	0	86	2.2	.1	1.6	140	77	77	19
June 1-10---------	17,920	64	1	4.5	25.8	6.3	1.5	.03	.40	22	6.8	8.4	1.3	0	102	2.5	.1	2.3	165	92	92	14
June 11-20--------	9,515	70	4	4.1	35.5	6.6	2.7	.07	.59	27	8.4	13	1.5	0	141	3.5	.2	1.6	221	122	122	26
June 21-30--------	9,840	72	1	4.9	24.7	5.7	.7	.02	.29	22	6.4	9.8	1.5	3	99	3.1	.1	1.1	162	86	83	10
July 1-10---------	3,498	75	5	4.0	35.0	6.2	2.0	.04	.31	25	8.3	14	3.3	0	136	3.0	.3	2.6	212	113	113	28
July 11-20--------	3,138	77	3	3.7	42.9	6.8	3.1	.09	.30	27	9.0	15	3.0	0	162	2.5	.2	1.6	237	133	133	42
July 21-31--------	1,438	77	3	3.6	64.3	8.0	3.9	.11	.75	44	15	26	3.3	0	269	5.8	.3	1.6	399	207	207	49
Aug. 1-10---------	1,876	77	9	3.5	69.9	8.0	4.9	.23	1.0	46	16	37		0	281	8.4	.3	2.0	426	226	226	66
Aug. 11-20--------	1,121	77	2	3.45	63.9	8.2	5.0	.10	1.1	38	13	30	1.7	0	244	7.5	.2	1.8	358	197	197	68
Aug. 21-31--------	970	74	2	3.35	88.0	10	6.7	.14	1.3	54	20	44	3.1	0	350	12	.3	1.0	522	281	281	86
Sept. 1-10--------	552	72	2	3.4	91.9	11	6.6	.21	1.2	59	22	56	4.5	0	385	16	.3	1.2	582	298	298	84
Sept. 11-20-------	603	72	2	3.2	121	11	8.7	.31	1.5	77	29	73	4.5	0	514	16	.3	1.0	749	399	399	120
Sept. 21-30-------	710	70	2	3.2	117	10	7.4	.46	1.5	71	27	71	5.1	0	486	16	.3	.6	712	369	369	120
Average---------	8,294	55	3	4.05	42.3	6.3	2.6	0.10	0.49	30	9.9	20	2.2	0	166	5.5	0.2	1.5	255	135	135	34

Monongahela River at Charleroi, Pa.

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^5$ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
Oct. 1-10, 1945	5,523	---	---	---	---	---	0.256	0.002	0.018	1.297	0.707	0.522	0.072	0.000	2.644	0.113	0.011	0.016	---	---	---	---
Oct. 11-20	5,047	---	---	---	---	---	.356	.005	.018	1.447	.798	.696	.077	.000	3.352	.141	.011	.013	---	---	---	---
Oct. 21-31	2,025	---	---	---	---	---	.400	.011	.016	1.747	1.069	1.044	.084	.000	4.229	.197	.011	.011	---	---	---	---
Nov. 1-10	4,585	---	---	---	---	---	.434	.011	.011	1.497	.905	.957	.082	.000	3.873	.226	.011	.011	---	---	---	---
Nov. 11-20	15,520	---	---	---	---	---	.145	.003	.011	1.198	.625	.565	.087	.000	2.415	.169	.005	.016	---	---	---	---
Nov. 21-30	21,360	---	---	---	---	---	.067	.002	.003	.699	.362	.291	.056	.015	1.249	.082	.005	.031	---	---	---	---
Dec. 1-10	17,030	---	---	---	---	---	.067	.003	.009	.798	.403	.352	.056	.000	1.499	.071	.011	.026	---	---	---	---
Dec. 11-20	7,419	---	---	---	---	---	.134	.002	.011	.898	.493	.478	.050	.000	1.895	.111	.011	.027	---	---	---	---
Dec. 21-31	9,551	---	---	---	---	---	.223	.003	.013	1.148	.748	.652	.054	.000	2.498	.144	.011	.029	---	---	---	---
Jan. 1-10, 1946	20,450	---	---	---	---	---	.078	.002	.005	.848	.428	.317	.041	.010	1.520	.090	.005	.029	---	---	---	---
Jan. 11-20	13,310	---	---	---	---	---	.134	.002	.011	.848	.436	.283	.041	.000	1.645	.056	.005	.020	---	---	---	---
Jan. 21-31	3,135	---	---	---	---	---	.323	.003	.014	1.297	.707	.696	.046	.000	3.081	.130	.005	.031	---	---	---	---
Feb. 1-10	9,423	---	---	---	---	---	.356	.005	.021	1.397	.732	.739	.046	.000	3.331	.124	.005	.027	---	---	---	---
Feb. 11-20	17,030	---	---	---	---	---	.056	.002	.009	.699	.329	.291	.031	.016	1.353	.079	.005	.031	---	---	---	---
Feb. 21-28	11,760	---	---	---	---	---	.022	.002	.000	.898	.403	.365	.020	.016	1.624	.085	.005	.032	---	---	---	---
Mar. 1-10	11,440	---	---	---	---	---	.067	.001	.004	.898	.444	.400	.023	.000	1.853	.062	.005	.020	---	---	---	---
Mar. 11-20	13,700	---	---	---	---	---	.033	.002	.007	.948	.452	.383	.031	.049	1.749	.090	.005	.026	---	---	---	---
Mar. 21-31	12,200	---	---	---	---	---	.078	.002	.010	.998	.485	.400	.023	.000	1.957	.090	.005	.023	---	---	---	---
Apr. 1-10	8,122	---	---	---	---	---	.044	.002	.013	1.098	.543	.478	.028	.033	2.165	.090	.005	.019	---	---	---	---
Apr. 11-20	3,444	---	---	---	---	---	.245	.002	.015	1.547	.748	.783	.038	.000	3.227	.260	.005	.021	---	---	---	---
Apr. 21-30	2,793	---	---	---	---	---	.367	.002	.020	1.697	.822	.957	.036	.000	3.977	.185	.011	.019	---	---	---	---
May 1-10	6,592	---	---	---	---	---	.334	.004	.015	1.447	.658	.696	.072	.000	3.373	.130	.005	.015	---	---	---	---
May 11-20	17,210	---	---	---	---	---	.145	.012	.009	1.248	.535	.565	.041	.000	2.415	.147	.005	.018	---	---	---	---
May 21-31	11,160	---	---	---	---	---	.133	.002	.009	.898	.461	.357	.031	.000	1.791	.062	.005	.026	---	---	---	---
June 1-10	17,920	---	---	---	---	---	.167	.002	.015	1.098	.559	.365	.033	.000	2.124	.071	.005	.037	---	---	---	---
June 11-20	9,515	---	---	---	---	---	.300	.004	.021	1.347	.691	.565	.038	.000	2.936	.099	.011	.026	---	---	---	---
June 21-30	9,840	---	---	---	---	---	.078	.001	.011	1.048	.526	.426	.038	.049	2.001	.087	.005	.018	---	---	---	---
July 1-10	3,498	---	---	---	---	---	.222	.002	.011	1.248	.683	.609	.084	.000	2.832	.085	.010	.042	---	---	---	---
July 11-20	3,130	---	---	---	---	---	.345	.005	.011	1.347	.740	.652	.077	.000	3.373	.071	.011	.026	---	---	---	---
July 21-31	1,438	---	---	---	---	---	.434	.006	.027	2.196	1.234	1.131	.084	.000	5.601	.164	.010	.026	---	---	---	---
Aug. 1-10	1,876	---	---	---	---	---	.545	.012	.036	2.295	1.316	1.606		.000	5.851	.237	.010	.032	---	---	---	---
Aug. 11-20	1,121	---	---	---	---	---	.556	.005	.040	1.896	1.069	1.305	.043	.000	5.080	.212	.011	.029	---	---	---	---
Aug. 21-31	970	---	---	---	---	---	.745	.008	.047	2.695	1.645	1.913	.079	.000	7.287	.338	.016	.016	---	---	---	---
Sept. 1-10	552	---	---	---	---	---	.734	.011	.044	2.944	1.809	2.435	.115	.000	8.016	.451	.016	.019	---	---	---	---
Sept. 11-20	603	---	---	---	---	---	.968	.017	.055	3.842	2.385	3.174	.115	.000	10.702	.451	.016	.016	---	---	---	---
Sept. 21-30	710	---	---	---	---	---	.823	.025	.055	3.543	2.220	3.087	.130	.000	10.119	.451	.016	.010	---	---	---	---
Average	8,294	---	---	---	---	---	0.289	0.005	0.018	1.497	0.814	0.870	0.056	0.000	3.456	0.155	0.011	0.024	---	---	---	---

P 88.49
8.10

MERCE

ROCEDURE

a State Librar

Beaver River at New Brighton, Pa.

Chemical analyses, in parts per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate
Oct. 1-10, 1945	5,421	60	17	6.8	27.2	8.4	0.09	0.00	30	7.2	9.8	3.4	40	69	14	0.5	4.0	185	104	72
Oct. 11-20	2,760	54	15	6.7	29.3	5.6	.08	.00	32	6.9	11	4.2	40	74	14	.3	3.4	185	108	75
Oct. 21-31	4,445	54	20	6.8	31.9	5.8	.15	.00	35	7.5	12	4.9	44	84	16	.2	4.1	202	118	82
Nov. 1-10	3,570	53	12	6.9	32.8	5.2	.08	.00	36	7.9	13	4.2	43	82	18	.3	3.8	198	122	87
Nov. 11-20	6,161	51	13	6.9	29.8	5.4	.07	.00	32	7.3	11	3.7	44	72	17	.3	3.5	178	110	74
Nov. 21-30	5,739	43	23	6.8	26.8	5.6	.20	.00	30	6.9	8.8	3.1	34	67	14	.3	4.0	164	103	75
Dec. 1-10	3,591	44	25	7.0	32.6	4.4	.22	.00	35	8.6	11	3.1	43	82	17	.3	4.4	196	123	87
Dec. 11-20	2,228	35	8	6.8	38.5	5.2	.04	.00	42	9.2	18	3.0	40	101	26	.4	8.2	229	143	110
Dec. 21-31	4,952	38	15	6.7	36.1	5.0	.07	.07	40	8.9	16	3.0	45	95	19	.4	6.9	225	136	100
Jan. 1-10, 1946	7,825	41	12	6.7	24.4	4.6	.13	.00	27	6.4	7.6	2.7	35	66	11	.2	5.0	150	94	65
Jan. 11-20	4,494	39	10	6.8	28.9	4.8	.09	.00	31	7.8	12	3.2	39	76	13	.2	5.5	175	109	77
Jan. 21-31	2,069	34	10	6.8	36.7	5.4	.06	.00	39	10	16	3.8	52	93	18	.3	6.8	228	138	96
Feb. 1-10	2,266	34	10	6.9	36.6	11	.05	.00	38	9.9	18	3.7	59	85	21	.3	6.3	226	136	87
Feb. 11-20	4,807	35	15	6.8	27.4	5.4	.12	.00	30	7.7	9.4	2.7	46	65	14	.3	4.7	167	106	69
Feb. 21-28	10,130	38	45	6.9	27.6	6.0	.61	.15	30	7.3	9.5	2.6	43	67	14	.3	4.6	172	105	70
Mar. 1-10	10,120	44	15	6.8	22.0	5.6	.19	.00	24	6.1	6.8	2.2	30	57	8.8	.2	4.3	138	85	60
Mar. 11-20	7,576	49	28	6.9	24.4	5.2	.37	.00	27	6.8	7.6	2.5	34	63	10	.2	3.8	153	95	67
Mar. 21-31	3,816	56	13	6.9	29.5	4.4	.13	.00	32	7.4	11	3.8	40	77	14	.3	4.7	181	110	78
Apr. 1-10	2,013	55	9	6.9	38.8	3.4	.09	.00	41	9.1	16	4.0	38	108	22	.4	4.9	240	140	109
Apr. 11-20	1,686	54	4	6.6	45.9	3.0	.16	---	50	11	21	2.6	37	137	27	.5	8.0	288	170	140
Apr. 21-30	1,464	60	10	6.7	45.8	2.8	.02	.00	50	11	20	4.6	45	128	28	.7	6.6	318	170	133
May 1-10	1,392	61	8	6.7	51.0	2.4	.06	.05	56	12	22	4.5	41	150	31	.6	7.8	354	189	155
May 11-20	3,943	63	10	7.0	33.3	4.6	.05	.00	37	8.5	11	2.6	53	82	17	.4	3.8	225	127	84
May 21-31	17,270	63	28	6.9	22.2	6.2	.22	.05	27	6.1	4.5	1.4	43	51	7.6	.2	2.2	152	92	57
June 1-10	6,033	66	10	7.2	28.8	6.0	.04	.00	34	7.7	11	3.0	52	73	12	.2	4.5	186	116	74
June 11-20	3,587	72	10	7.1	32.1	4.6	.02	.00	36	7.9	14	3.4	50	78	17	.4	5.1	202	122	81
June 21-30	3,677	74	10	7.2	29.6	5.0	.04	.00	34	8.0	12	3.0	53	71	13	.3	5.4	190	118	74
July 1-10	1,707	79	7	6.6	38.8	4.7	.02	.00	43	8.7	17	4.4	52	105	19	.5	7.1	251	143	100
July 11-20	1,205	82	10	6.6	42.7	3.5	.02	.00	48	9.4	14	3.5	50	116	19	.7	7.8	269	158	117
July 21-31	1,591	79	12	6.7	41.9	4.4	.03	.00	48	9.1	17	3.6	50	117	22	.4	7.2	267	157	116
Aug. 1-10	1,224	79	10	6.6	42.1	5.2	.03	.05	47	9.6	18	5.9	46	119	22	.7	7.7	271	157	119
Aug. 11-20	1,318	77	10	6.6	43.1	4.6	.03	.05	49	9.6	20	5.8	44	123	24	.7	7.7	281	162	126
Aug. 21-31	978	73	12	6.5	42.9	4.6	.03	.03	48	9.3	19	6.3	41	123	23	.7	9.0	276	158	124
Sept. 1-10	833	73	7	6.6	45.4	3.2	.02	.13	51	10	18	6.1	44	136	24	.9	6.8	292	168	132
Sept. 11-20	802	74	5	6.6	46.7	3.2	.01	.19	54	10	19	6.2	35	146	24	1.5	8.1	303	176	147
Sept. 21-30	803	74	7	6.5	48.5	2.6	.02	.08	54	10	21	6.4	34	153	26	1.1	9.2	316	176	148
Average	3,972	57	13	6.8	35.1	4.9	0.10	0.02	39	8.5	14	3.8	43	94	18	0.4	5.7	223	132	97

Beaver River at New Brighton, Pa.

Chemical analyses, in equivalents per million, water year October 1945 to September 1946

Date of collection	Mean discharge (second feet)	Temperature (°F.)	Color	pH	Specific conductance (K x 10^5 at 25°C.)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate
Oct. 1-10, 1945	5,421	---	---	---	---	---	---	---	1.497	0.592	0.426	0.087	0.656	1.437	0.395	0.026	0.065	---	---	---
Oct. 11-20	2,760	---	---	---	---	---	---	---	1.597	.567	.478	.107	.656	1.541	.395	.016	.055	---	---	---
Oct. 21-31	4,445	---	---	---	---	---	---	---	1.747	.617	.522	.125	.721	1.749	.451	.011	.066	---	---	---
Nov. 1-10	3,570	---	---	---	---	---	---	---	1.796	.650	.565	.107	.705	1.707	.508	.016	.061	---	---	---
Nov. 11-20	6,161	---	---	---	---	---	---	---	1.597	.600	.478	.095	.721	1.499	.479	.016	.056	---	---	---
Nov. 21-30	5,739	---	---	---	---	---	---	---	1.497	.567	.383	.079	.557	1.395	.395	.016	.065	---	---	---
Dec. 1-10	3,591	---	---	---	---	---	---	---	1.747	.707	.478	.079	.705	1.707	.479	.016	.071	---	---	---
Dec. 11-20	2,228	---	---	---	---	---	---	---	2.096	.757	.783	.077	.656	2.103	.733	.021	.132	---	---	---
Dec. 21-31	4,952	---	---	---	---	---	---	---	1.996	.732	.696	.077	.737	1.978	.536	.021	.111	---	---	---
Jan. 1-10, 1946	7,825	---	---	---	---	---	---	---	1.347	.526	.330	.069	.574	1.374	.310	.011	.081	---	---	---
Jan. 11-20	4,494	---	---	---	---	---	---	---	1.547	.641	.522	.082	.639	1.582	.367	.011	.089	---	---	---
Jan. 21-31	2,069	---	---	---	---	---	---	---	1.946	.822	.696	.097	.852	1.936	.508	.016	.110	---	---	---
Feb. 1-10	2,266	---	---	---	---	---	---	---	1.896	.814	.783	.095	.967	1.770	.592	.016	.102	---	---	---
Feb. 11-20	4,807	---	---	---	---	---	---	---	1.497	.633	.409	.069	.754	1.353	.395	.016	.076	---	---	---
Feb. 21-28	10,130	---	---	---	---	---	---	---	1.497	.600	.413	.066	.705	1.395	.395	.016	.074	---	---	---
Mar. 1-10	10,120	---	---	---	---	---	---	---	1.198	.502	.296	.056	.492	1.187	.248	.011	.069	---	---	---
Mar. 11-20	7,576	---	---	---	---	---	---	---	1.347	.559	.330	.064	.557	1.312	.282	.011	.061	---	---	---
Mar. 21-31	3,816	---	---	---	---	---	---	---	1.597	.609	.478	.097	.656	1.603	.395	.016	.076	---	---	---
Apr. 1-10	2,013	---	---	---	---	---	---	---	2.046	.748	.696	.102	.623	2.249	.620	.021	.079	---	---	---
Apr. 11-20	1,686	---	---	---	---	---	---	---	2.495	.905	.907	.067	.606	2.852	.761	.026	.129	---	---	---
Apr. 21-30	1,464	---	---	---	---	---	---	---	2.495	.905	.870	.118	.737	2.665	.790	.037	.106	---	---	---
May 1-10	1,392	---	---	---	---	---	---	---	2.794	.987	.957	.115	.672	3.123	.874	.032	.126	---	---	---
May 11-20	3,943	---	---	---	---	---	---	---	1.846	.699	.478	.067	.869	1.707	.479	.021	.061	---	---	---
May 21-31	17,270	---	---	---	---	---	---	---	1.347	.502	.196	.036	.705	1.062	.214	.011	.035	---	---	---
June 1-10	6,033	---	---	---	---	---	---	---	1.697	.633	.478	.077	.852	1.520	.338	.011	.073	---	---	---
June 11-20	3,587	---	---	---	---	---	---	---	1.796	.650	.609	.087	.819	1.624	.479	.021	.082	---	---	---
June 21-30	3,677	---	---	---	---	---	---	---	1.697	.658	.522	.077	.689	1.478	.367	.016	.067	---	---	---
July 1-10	1,707	---	---	---	---	---	---	---	2.146	.715	.739	.113	.852	2.186	.536	.026	.116	---	---	---
July 11-20	1,205	---	---	---	---	---	---	---	2.395	.773	.609	.090	.819	2.415	.536	.037	.126	---	---	---
July 21-31	1,591	---	---	---	---	---	---	---	2.395	.748	.739	.092	.819	2.436	.620	.021	.116	---	---	---
Aug. 1-10	1,224	---	---	---	---	---	---	---	2.345	.723	.783	.151	.754	2.478	.620	.037	.124	---	---	---
Aug. 11-20	1,318	---	---	---	---	---	---	---	2.445	.780	.870	.148	.721	2.561	.677	.037	.124	---	---	---
Aug. 21-31	978	---	---	---	---	---	---	---	2.395	.765	.826	.161	.672	2.461	.649	.037	.145	---	---	---
Sept. 1-10	833	---	---	---	---	---	---	---	2.545	.822	.783	.156	.721	2.632	.677	.047	.110	---	---	---
Sept. 11-20	802	---	---	---	---	---	---	---	2.695	.822	.826	.169	.754	3.040	.677	.079	.161	---	---	---
Sept. 21-30	803	---	---	---	---	---	---	---	2.695	.822	.913	.164	.557	3.186	.733	.058	.145	---	---	---
Average	3,972	---	---	---	---	---	---	---	1.946	0.699	0.609	0.097	0.705	1.967	0.508	0.021	0.082	---	---	---

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MERCE
ROCEDURE
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Cross-section samples of Susquehanna River at Danville, Pa., 1945 and 1946

Date	Discharge (second-feet)	Station	Time	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Parts per million					Equivalents per million				
								Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$
Nov. 4, 1945		1180	12:00m	43	5	6.3	22.3	24	76	3	1.5	87	0.393	1.582	0.085	0.024	1.740
		880		4	10	6.6	21.9	36	68	3	1.4	88	.590	1.416	.085	.023	1.760
		650		4	10	6.6	21.9	42	65	3	1.5	90	.688	1.353	.085	.024	1.800
		465		48	10	6.6	21.1	---	---	---	---	---	---	---	---	---	---
		120		46	10	6.6	16.5	33	47	3	2.0	64	.541	.979	.085	.032	1.280
Nov. 14		1180	12:30pm	53	6	6.4	16.9	23	54	4	1.8	72	.377	1.124	.113	.029	1.440
		880		52	4	6.2	17.2	32	50	3	1.4	69	.524	1.041	.085	.023	1.380
		650		52	5	6.5	16.8	38	45	3	1.8	74	.623	.937	.085	.029	1.480
		465		52	---	7.0	16.7	---	---	---	---	---	---	---	---	---	---
		120		52	6	6.4	12.9	30	31	3	2.2	54	.492	.645	.085	.036	1.080
Nov. 24		1180	1:00pm	38	6	6.1	12.4	19	42	2	1.8	51	.311	.874	.056	.029	1.020
		880		38	7	6.9	12.1	22	37	2	1.4	50	.361	.770	.056	.023	1.000
		650		38	7	6.4	12.0	27	35	2	1.4	51	.442	.729	.056	.023	1.020
		465		38	---	6.8	11.7	---	---	---	---	---	---	---	---	---	---
		120		38	8	6.3	10.6	25	27	2	1.6	50	.410	.562	.056	.026	1.000
Dec. 4		1180	1:00pm	36	2	6.2	17.2	15	57	5	1.4	66	.246	1.187	.141	.023	1.320
		880		32	3	6.4	16.7	24	51	3	1.7	69	.393	1.062	.085	.027	1.380
		650		32	3	6.7	16.2	30	43	4	1.3	63	.492	.895	.113	.021	1.260
		465		32	---	7.0	16.1	---	---	---	---	---	---	---	---	---	---
		120		36	3	6.7	14.1	29	35	3	2.0	62	.475	.729	.085	.032	1.240
Dec. 14		1100	11:30am	34	7	6.1	18.9	10	71	3	1.8	75	.164	1.478	.085	.029	1.500
		880		34	8	6.4	19.4	22	64	4	2.2	69	.361	1.332	.113	.036	1.380
		650		34	6	6.5	18.9	29	58	4	1.9	72	.475	1.208	.113	.031	1.440
		465		34	---	6.7	18.7	---	---	---	---	---	---	---	---	---	---
		120		34	5	6.6	16.2	29	48	2	2.6	66	.475	.999	.056	.042	1.320
Dec. 27		1180	1:00pm	32	4	5.8	21.6	8	84	6	2.4	90	.131	1.749	.169	.039	1.800
		880		32	5	6.1	25.6	16	103	5	2.5	94	.262	2.144	.141	.040	1.880
		650		32	5	6.4	27.7	28	102	5	2.8	98	.459	2.124	.141	.045	1.960
		465		32	---	6.6	27.5	---	---	---	---	---	---	---	---	---	---
		120		32	4	6.5	21.3	29	73	5	3.2	84	.475	1.520	.141	.052	1.680
Jan. 4, 1946		1180	12:30pm	---	4	6.1	21.0	14	85	4	1.9	74	.229	1.770	.113	.031	1.480
		880		---	3	6.4	22.0	26	75	5	2.2	80	.426	1.562	.141	.036	1.600
		650		---	5	6.6	21.6	34	67	5	2.2	99	.557	1.395	.141	.036	1.980
		465		---	---	6.5	21.3	---	---	---	---	---	---	---	---	---	---
		120		---	4	6.7	18.1	31	52	3	2.5	76	.508	1.083	.085	.040	1.520
Jan. 14		1180	12:30pm	33	5	6.4	14.7	14	51	4	1.8	52	.229	1.062	.113	.029	1.040
		880		33	4	6.5	14.3	21	48	2	1.8	63	.344	.999	.056	.029	1.260
		650		33	6	6.6	13.8	27	36	4	1.8	57	.442	.750	.113	.029	1.140
		465		32	---	6.7	13.4	---	---	---	---	---	---	---	---	---	---
		120		33	6	6.7	12.3	25	30	2	1.6	51	.410	.625	.056	.026	1.020

Cross-section samples of Susquehanna River at Danville, Pa., 1945 and 1946--Continued

Date	Discharge (second-feet)	Station	Time	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Parts per million					Equivalents per million				
								Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$
Jan. 23		1180	1:00pm	31	4	6.3	26.4	17	100	6	1.6	117	0.279	2.082	0.169	0.026	2.340
		880		31	4	6.4	26.6	20	99	5	1.8	120	.328	2.061	.141	.029	2.400
		650		31	4	6.5	27.5	31	91	5	2.4	108	.508	1.895	.141	.039	2.160
		465		31	---	6.7	27.3	---	---	---	---	---	---	---	---	---	---
		120		31	5	6.6	23.7	33	73	5	2.3	84	.541	1.520	.141	.037	1.680
Feb. 4		1180	4:00pm	---	4	6.5	29.7	31	103	6	1.8	114	.508	2.144	.169	.029	2.280
		650		---	4	6.7	29.7	44	96	9	2.7	104	.721	1.999	.254	.044	2.080
		465		---	---	6.8	29.4	---	---	---	---	---	---	---	---	---	---
Feb. 14		1180	5:00pm	37	5	6.2	25.4	19	89	7	2.6	105	.311	1.853	.197	.042	2.100
		880		39	5	6.6	30.4	37	102	8	1.7	126	.606	2.124	.226	.027	2.520
		650		30	5	6.8	30.7	51	88	6	4.1	128	.836	1.832	.169	.066	2.560
		465		41	---	6.8	30.2	---	---	---	---	---	---	---	---	---	---
		120		39	15	6.6	20.2	34	51	5	5.7	84	.557	1.062	.141	.092	1.680
Feb. 23		1180	1:00pm	34	5	6.1	24.2	18	89	4	2.0	99	.213	1.853	.113	.032	1.980
		880		34	5	6.4	25.3	21	87	4	1.9	105	.344	1.811	.113	.031	2.100
		650		34	7	6.6	24.5	32	76	4	3.7	94	.524	1.582	.113	.060	1.880
		465		34	---	6.6	23.7	---	---	---	---	---	---	---	---	---	---
		120		34	10	6.7	20.5	34	55	4	3.4	75	.557	1.145	.113	.055	1.500
Mar. 3		1180	12:30pm	34	8	6.2	15.0	20	42	4	3.2	60	.328	.874	.113	.052	1.200
		880		34	15	6.3	14.8	28	45	5	3.6	62	.459	.729	.141	.061	1.240
		650		34	18	6.4	14.5	33	30	4	2.7	57	.541	.625	.113	.044	1.140
		465		34	--	6.6	14.1	---	---	---	---	---	---	---	---	---	---
		120		34	15	6.7	13.3	28	26	9	4.3	56	.459	.541	.254	.069	1.120
Mar. 14		1180	4:30pm	44	5	6.2	17.2	15	50	3	3.4	60	.246	1.041	.085	.055	1.200
		880		44	5	6.4	12.9	24	46	2	2.7	58	.393	.958	.056	.044	1.160
		650		42	5	6.5	12.3	28	42	4	2.6	57	.459	.874	.113	.042	1.140
		465		43	---	6.6	12.0	---	---	---	---	---	---	---	---	---	---
		120		42	7	6.5	10.7	24	43	2	2.9	54	.393	.895	.056	.047	1.080
Mar. 24		1180	4:00pm	42	5	6.3	16.8	17	65	3	2.2	72	.279	1.353	.085	.035	1.440
		880		42	5	6.6	17.3	24	60	4	2.7	72	.393	1.249	.113	.044	1.440
		650		42	5	6.5	16.8	29	55	4	2.6	75	.475	1.145	.113	.042	1.500
		465		42	---	6.8	16.4	---	---	---	---	---	---	---	---	---	---
		120		42	7	6.6	14.2	28	43	4	2.8	63	.459	.895	.113	.045	1.260
Apr. 4		1180	4:00pm	54	0	6.1	21.0	13	58	4	2.4	90	.213	1.208	.113	.039	1.800
		880		53	1	6.3	23.0	26	54	4	2.2	96	.426	1.124	.113	.035	1.920
		650		52	2	6.7	23.6	38	---	---	---	---	.623	---	---	---	---
		465		52	---	7.0	22.7	---	---	---	---	---	---	---	---	---	---
		120		53	0	6.8	19.5	36	42	4	2.6	81	.590	.874	.113	.042	1.620
Apr. 14		1180	1:30pm	52	0	6.3	25.0	24	90	4	2.1	108	.393	1.874	.113	.034	2.160
		880		52	1	6.6	26.4	38	86	4	1.8	110	.623	1.832	.113	.029	2.200
		650		---	0	6.7	26.4	48	81	5	2.2	114	.787	1.686	.141	.035	2.280
		465		53	---	6.9	27.0	---	---	---	---	---	---	---	---	---	---
		120		52	0	6.7	22.8	40	61	4	2.3	96	.787	1.353	.113	.037	1.920

P38.42
2.120

MERCE

ROCEDURE

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Cross-section samples of Susquehanna River at Danville, Pa., 1945 and 1946—Continued

Date	Discharge (second-feet)	Station	Time	Temperature (°F.)	Color	pH	Specific conductance (K×10⁶ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$
Apr. 24		1180	4:00pm	64	2	6.2	27.7	1[illegible]	10	6	2.6	101	0.2[illegible]	0.0[illegible]	0.169	0.042	2.160
		[illegible]0		63	2	6.4	[illegible]	[illegible]	7	[illegible]	2.6	102	.[illegible]	.020	.169	.042	2.040
		650		64	3	6.6	27.7	4[illegible]	9	[illegible]	2.6	96	.[illegible]	.[illegible]	.169	.042	1.920
		465		64	---	6.8	26.0	---	---	---	---	---	---	---	---	---	---
		120		63	3	6.7	23.0	43	70	6	3.0	108	.705	1.457	.169	.048	2.160
May 4		1180	1:30pm	58	4	6.[illegible]	26.[illegible]	30	[illegible]7	6	2.6	[illegible]6	.[illegible]00	1.811	.169	.042	1.920
		880		57	4	6.6	26.[illegible]	41	[illegible]4	[illegible]	2.3	102	.[illegible]7[illegible]	1.749	.[illegible]00	.037	2.040
		650		56	3	6.8	26.[illegible]	51	75	[illegible]	2.0	1[illegible]8	.[illegible]30	1.562	.[illegible]7	.032	2.160
		465		57	---	6.9	25.9	---	---	---	---	---	---	---	---	---	---
		120		57	4	6.9	21.2	49	64	8	2.4	90	.[illegible]00	1.332	.[illegible]23	.039	1.800
May 15		1180	3:00pm	69	3	6.3	19.3	1[illegible]	[illegible]1	4	1.6	72	.2[illegible]2	1.[illegible]70	.113	.023	1.440
		[illegible]90		69	4	6.6	20.1	2[illegible]	[illegible]5	5	1.4	[illegible]5	.4[illegible]6	1.[illegible]12	.141	.023	1.500
		650		60	4	6.6	23.0	3[illegible]	[illegible]4	6	1.2	[illegible]1	.[illegible]574	1.[illegible]12	.169	.019	1.620
		465		59	---	6.7	22.2	---	---	---	---	---	---	---	---	---	---
		120		59	3	6.[illegible]	17.5	35	47	[illegible]	1.0	64	.574	.979	.085	.031	1.280
May 25		1180	12:00[illegible]	[illegible]4	4	6.1	11.[illegible]	7	40	[illegible]	1.[illegible]	45	.115	.[illegible]33	.056	.024	.900
		880		[illegible]4	5	6.3	11.2	1[illegible]	38	1	1.7	45	.262	.791	.028	.027	.900
		650		[illegible]-	5	6.5	10.8	1[illegible]	32	[illegible]	1.[illegible]	45	.311	.[illegible]33	.056	.026	.900
		465		65	---	6.5	10.[illegible]	---	---	---	---	---	---	---	---	---	---
		120		64	7	6.5	9.[illegible]1	1[illegible]	27	1	1.6	39	.311	.562	.028	.026	.780
June 1		1185	10:45am	[illegible]2	3	6.2	13.1	12	48	2	2.4	51	.197	.937	.056	.039	1.020
		880		[illegible]0	[illegible]	6.5	12.9	20	41	3	1.9	40	.328	.[illegible]54	.[illegible]8	.031	.960
		650		62	[illegible]	[illegible].7	12.5	23	37	2	2.0	51	.377	.770	.056	.032	1.020
		465		62	[illegible]	6.7	12.1	25	36	2	2.3	51	.410	.750	.056	.037	1.020
		120		62	5	6.7	11.2	24	32	2	2.1	51	.[illegible]03	.[illegible]66	.056	.034	1.020
June 5		1180	12:30pm	58	4	[illegible].3	13.3	1[illegible]	44	1	2.5	48	.2[illegible]	.[illegible]16	.028	.040	.960
		880		58	6	[illegible].4	13.[illegible]	21	40	1	2.5	55	.344	.[illegible]33	.028	.040	1.100
		650		59	6	[illegible].7	13.[illegible]	2[illegible]	38	1	2.5	51	.4[illegible]	.[illegible]29	.028	.040	1.020
		465		59	---	[illegible].7	12.5	---	---	---	---	---	---	---	---	---	---
		120		58	7	[illegible].4	11.4	[illegible]	[illegible]3	1	[illegible].7	48	.410	.[illegible]04	.028	.044	.960
June 14		1180	3:00pm	66	4	6.2	16.7	1[illegible]	[illegible]2	[illegible]	4.2	[illegible]9	.2[illegible]	1.[illegible]1	.[illegible]0	.[illegible]0	1.500
		[illegible]80		66	3	6.6	19.4	[illegible]3	[illegible]0	[illegible]	3.2	7[illegible]	.[illegible]41	1.[illegible]43	.[illegible]26	.[illegible]5[illegible]	1.[illegible]9
		650		67	3	6.8	19.[illegible]	[illegible]9	[illegible]5	2	3.0	[illegible]1	.[illegible]05	1.145	.[illegible]6	.[illegible]4[illegible]	1.620
		465		67	---	[illegible].9	18.[illegible]	[illegible]-	---	---	---	---	---	---	---	---	---
		120		66	3	6.7	16.8	37	41	3	3.[illegible]	74	.[illegible]06	.[illegible]34	.[illegible]85	.061	1.480
June 24		1180	1:30pm	72	2	6.4	[illegible]2.[illegible]	1[illegible]	[illegible]0	3	2.3	[illegible]1	.[illegible]11	1.[illegible]13	.[illegible]28	.037	1.640
		880		70	2	6.7	22.[illegible]	34	79	2	2.0	[illegible]3	.[illegible]507	1.646	.[illegible]56	.032	1.960
		650		71	2	6.9	22.1	42	70	2	1.9	[illegible]4	.[illegible]66	1.457	.[illegible]56	.031	1.880
		465		72	---	6.9	21.[illegible]	---	---	---	---	---	---	---	---	---	---
		120		72	1	6.8	[illegible]0.1	42	[illegible]0	2	2.2	[illegible]5	.[illegible]13	1.2[illegible]	.[illegible]8	.[illegible]36	1.760

Chemical analyses of surface-water samples collected at Ironville, Pa., July and August—Continued

Date	Discharge (second-feet)	Station	Time	Temperature (°F.)	Color	pH	Specific conductance (K×10⁶ at 25°C.)	Parts per million: Silica (SiO_2)	Sulfate (SO_4)	Calcium (Ca)	Magnesium (Mg)	Total residue on evaporation ($180°C$)	Equivalents per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$
July 4		110	11:00am	74	1	6.7	41.5	37	97	12	2.4	92	0.606	1.020	0.085	0.024	1.010
		990		74	1	6.8	40.1	40	89	13	2.3	90	.746	1.248	.085	.037	1.000
		650		74	---	6.7	39.6	45	---	---	2.4	90	.697	1.145	.085	.021	1.000
		465		74	---	7.0	39.4	---	91	---	---	---	---	---	---	---	---
		120		71	1	6.8	39.0	42	---	---	2.5	91	.705	1.062	.082	.040	1.020
July 14		110	11:30am	74	3	6.8	27.6	20	110	11	1.7	120	.492	1.240	.096	.047	2.490
		990		74	4	6.7	28.9	28	110	13	1.9	113	.541	1.248	.096	.031	2.480
		650		74	4	6.9	28.6	37	99	12	1.9	124	.541	1.061	.096	.021	2.430
		465		74	---	7.0	28.5	---	---	---	---	---	---	---	---	---	---
		120		73	4	7.0	28.4	39	91	11	2.1	118	.574	.979	.096	.034	2.360
July 24		1180	12:00m	78	4	6.4	30.0	15	111	4	2.3	120	.410	2.448	.113	.047	2.420
		990		78	5	6.8	31.2	19	130	4	2.2	124	.311	2.480	.113	.066	2,420
		650		79	6	6.4	31.2	31	111	4	1.6	118	.508	2.311	.113	.029	2,700
		465		79	---	6.9	31.0	---	---	---	---	---	---	---	---	---	---
		120		79	4	7.1	28.6	50	88	4	2.4	120	.410	1.862	.113	.029	2.400
Aug. 4		1180	2:30pm	74	6	6.4	26.7	23	94	4	2.0	10	.377	1.957	.113	.012	2.120
		990		74	6	6.6	28.3	35	86	4	1.9	104	.574	1.833	.111	.031	2,080
		650		74	7	6.7	24.2	40	72	3	2.0	100	.656	1.499	.093	.032	2.000
		465		74	---	6.7	23.7	---	---	---	---	---	---	---	---	---	---
		120		74	10	6.8	23.2	37	67	3	2.0	90	.606	1.478	.096	.032	1.880
Aug. 14		1180	12:00m	74	3	5.8	29.9	12	129	---	2.7	120	.197	---	---	---	---
		990		74	2	6.2	29.9	20	121	2	2.6	114	.328	1.911	.085	.044	2.440
		650		74	2	6.4	29.0	26	107	3	2.6	110	.492	2.229	.085	.042	2.560
		465		74	---	6.5	27.4	---	---	---	---	---	---	---	---	---	---
		120		73	1	6.6	25.4	31	91	2	3.1	110	.475	1.705	.085	.050	2.040
Aug. 24		1180	1:00pm	72	2	6.1	31.0	13	132	4	2.1	120	.229	2.748	.111	.034	2.400
		990		72	3	6.1	31.5	14	129	4	2.0	122	.328	2.679	.113	.047	2.480
		650		70	3	6.2	30.7	21	120	4	2.6	111	.541	2.498	.111	.042	2.430
		465		70	---	6.4	31.5	---	---	---	---	---	---	---	---	---	---
		120		68	2	6.4	28.5	29	91	2	3.0	117	.475	1.905	.096	.032	2.340
Sept. 4		1180	4:00pm	76	3	5.1	46.0	1	208	6	1.0	213	.016	4.331	.102	.016	4.260
		990		74	3	4.7	46.7	8.0	223	7	2.5	216	.000	4.443	.107	.040	4.320
		650		72	3	5.1	44.4	2	222	6	2.0	204	.032	4.022	.109	.032	4.060
		465		72	---	6.4	47.5	---	---	---	---	---	---	---	---	---	---
		120		74	2	6.4	41.0	22	166	6	3.2	158	.341	3.456	.109	.052	3.160
Sept. 11		1180	1:00pm	69	2	4.8	47.0	90	219	7	2.7	210	.000	4.560	.107	.044	4.200
		990		69	1	5.3	46.6	2	227	8	2.3	210	.033	4.726	.205	.037	4.230
		650		69	1	6.1	45.2	6	226	8	3.7	210	.098	4.747	.226	.060	4.200
		465		69	---	6.5	43.8	---	---	---	---	---	---	---	---	---	---
		120		69	1	6.5	40.3	26	186	8	4.1	186	.426	3.873	.226	.066	3.720
Sept. 24		1180	1:00pm	73	1	5.4	41.0	4	170	8	3.7	156	.066	3.539	.226	.060	3.160
		990		73	1	6.1	41.4	4	213	8	1.0	207	.066	4.435	.226	.016	4.140
		650		72	1	6.5	51.2	10	226	8	1.4	216	.164	4.705	.226	.023	4.320
		465		72	---	6.4	51.2	---	---	---	---	---	---	---	---	---	---
		120		73	2	6.5	41.7	27	170	8	3.7	153	.442	3.539	.226	.060	3.660

[1] Free acid as H_2SO_4 = 0

a State Libra
ROCEDURE
MERCE
P38.49
2:10

Susquehanna River at Harrisburg, Pa.

Cross-section samples for water year ended September 30, 1945

Date	Discharge (second-feet)	Sampling point: Channel	Sampling point: Station	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Parts per million: Sulfate (SO_4)	Parts per million: Chloride (Cl)	Parts per million: Nitrate (NO_3)	Parts per million: Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Equivalents per million: Sulfate (SO_4)	Equivalents per million: Chloride (Cl)	Equivalents per million: Nitrate (NO_3)	Equivalents per million: Total hardness as $CaCO_3$
Oct. 7, 1944	4,470	East	140	62	6	5.9	51.2	5	227	6	---	240	0.082	4.726	0.169	---	4.800
			300	62	7	6.2	50.0	---	---	---	---	---	---	---	---	---	---
			500	62	6	6.4	44.2	---	---	---	---	---	---	---	---	---	---
			690	62	3	6.6	36.9	20	136	8	---	162	.328	2.832	.226	---	3.240
			920	63	4	6.8	32.9	---	---	---	---	---	---	---	---	---	---
			1220	62	4	6.5	32.6	---	---	---	---	---	---	---	---	---	---
		West	300	62	7	6.8	31.4	---	---	---	---	---	---	---	---	---	---
			600	61	8	7.0	34.1	---	---	---	---	---	---	---	---	---	---
			900	61	12	7.2	38.9	---	---	---	---	---	---	---	---	---	---
			1100	61	13	7.5	38.9	116	77	13	---	144	1.901	1.603	.367	---	2.880
			1300	64	6	7.5	31.4	156	19	6	---	150	2.557	.396	.169	---	3.000
Oct. 16	7,490	East	140	49	4	5.0	52.0	1	233	7	---	234	.016	4.851	.197	---	4.680
			300	50	3	5.7	50.3	---	---	---	---	---	---	---	---	---	---
			500	49	3	6.2	44.8	---	---	---	---	---	---	---	---	---	---
			690	50	6	6.7	35.9	18	135	7	---	153	.295	2.811	.197	---	3.060
			920	50	7	6.7	29.5	---	---	---	---	---	---	---	---	---	---
			1220	50	7	6.6	26.5	---	---	---	---	---	---	---	---	---	---
		West	300	49	7	6.8	25.7	---	---	---	---	---	---	---	---	---	---
			600	49	11	7.1	23.0	---	---	---	---	---	---	---	---	---	---
			900	50	18	7.4	33.9	96	76	10	---	126	1.573	1.582	.282	---	2.520
			1100	49	18	7.4	33.2	---	---	---	---	---	---	---	---	---	---
			1300	49	7	7.7	30.5	153	18	6	---	144	2.507	.375	.169	---	2.880
Oct. 24	17,800	East	140	50	3	5.9	30.3	6	115	8	---	132	.098	2.394	.226	---	2.640
			300	50	4	6.4	30.0	---	---	---	---	---	---	---	---	---	---
			500	50	4	6.9	28.5	---	---	---	---	---	---	---	---	---	---
			690	51	6	7.0	25.7	45	67	8	---	103	.737	1.395	.226	---	2.160
			920	50	6	6.9	23.4	---	---	---	---	---	---	---	---	---	---
			1220	51	9	6.9	22.0	---	---	---	---	---	---	---	---	---	---
		West	300	50	22	7.0	23.2	---	---	---	---	---	---	---	---	---	---
			600	50	55	7.1	29.2	---	---	---	---	---	---	---	---	---	---
			900	---	55	7.2	33.9	105	50	9	---	132	1.721	1.041	.254	---	2.640
			1100	50	40	7.1	27.8	---	---	---	---	---	---	---	---	---	---
			1300	50	22	7.3	22.2	82	23	3	---	93	1.344	.479	.085	---	1.860
Nov. 1	8,960	East	140	49	5	6.5	33.1	16	131	6	---	162	.262	2.727	.169	---	3.240
			300	50	6	6.8	32.5	---	---	---	---	---	---	---	---	---	---
			500	50	5	6.9	27.7	---	---	---	---	---	---	---	---	---	---
			690	50	6	7.0	23.5	43	65	6	---	93	.705	1.353	.169	---	1.860
			920	50	6	6.9	20.9	---	---	---	---	---	---	---	---	---	---
			1220	50	6	6.8	19.1	---	---	---	---	---	---	---	---	---	---
		West	300	49	6	6.8	18.5	---	---	---	---	---	---	---	---	---	---
			600	49	6	6.7	18.9	---	---	---	---	---	---	---	---	---	---
			900	50	12	7.2	24.0	---	---	---	---	---	---	---	---	---	---
			1100	50	21	7.4	27.7	76	59	7	---	108	1.246	1.228	.197	---	2.160
			1300	50	7	7.7	27.5	126	21	5	---	132	2.065	.437	.141	---	2.640
Nov. 9	6,220	East	140	47	6	6.9	39.5	15	164	6	---	180	.246	3.415	.169	---	3.600
			300	47	6	6.9	37.8	---	---	---	---	---	---	---	---	---	---
			500	47	9	7.2	33.8	---	---	---	---	---	---	---	---	---	---
			690	47	9	7.2	27.5	33	90	6	---	114	.541	1.874	.169	---	2.280
			920	47	9	7.3	23.4	---	---	---	---	---	---	---	---	---	---
			1220	48	9	7.2	20.7	---	---	---	---	---	---	---	---	---	---
		West	300	48	9	7.2	19.9	---	---	---	---	---	---	---	---	---	---
			600	47	10	7.2	21.0	---	---	---	---	---	---	---	---	---	---
			900	47	31	7.3	28.2	---	---	---	---	---	---	---	---	---	---
			1100	47	40	7.4	32.2	93	67	8	---	114	1.524	1.395	.226	---	2.280
			1300	48	11	7.5	29.7	127	23	5	---	132	2.081	.479	.141	---	2.640

Cross-section samples for water year ended September 30, 1945--Continued

Date	Discharge (second-feet)	Sampling point Channel	Station	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$
Nov. 17, 1944--	7,620	East	140	44	5	6.0	43.9	10	185	8	---	186	0.164	3.852	0.226	---	3.720
			300	44	4	6.6	42.6	---	---	---	---	---	---	---	---	---	---
			500	45	7	6.7	37.3	---	---	---	---	---	---	---	---	---	---
			690	44	8	6.9	32.0	43	107	8	---	120	.705	2.228	.226	---	2.400
			920	44	4	6.9	27.9	---	---	---	---	---	---	---	---	---	---
			1220	45	4	7.0	24.9	36	77	7	---	99	.590	1.603	.197	---	1.980
		West	300	45	5	6.9	23.5	---	---	---	---	---	---	---	---	---	---
			600	44	5	6.9	22.6	---	---	---	---	---	---	---	---	---	---
			900	44	10	7.1	27.2	---	---	---	---	---	---	---	---	---	---
			1100	44	22	7.3	33.0	94	75	12	---	111	1.541	1.562	.338	---	2.220
			1300	45	8	7.6	33.0	167	25	8	---	159	2.737	.521	.226	---	3.180
Nov. 28--------	12,500	East	140	40	5	6.3	28.4	12	108	12	---	123	.197	2.249	.338	---	2.460
			300	40	5	6.4	26.8	---	---	---	---	---	---	---	---	---	---
			500	40	5	6.7	22.0	30	73	5	---	84	.492	1.520	.141	---	1.680
			920	40	5	6.9	19.3	---	---	---	---	---	---	---	---	---	---
			1220	41	5	6.8	19.8	27	62	5	---	76	.442	1.291	.141	---	1.520
		West	300	41	5	7.3	19.9	---	---	---	---	---	---	---	---	---	---
			600	41	5	6.7	20.7	---	---	---	---	---	---	---	---	---	---
			900	41	12	7.0	23.7	---	---	---	---	---	---	---	---	---	---
			1100	41	45	7.1	30.9	82	72	10	---	117	1.344	1.499	.282	---	2.340
			1300	41	10	7.5	31.7	151	26	10	---	150	2.475	.541	.282	---	3.000
Dec. 5---------	19,200	East	140	34	2	6.3	21.3	14	77	4	---	84	.229	1.603	.113	---	1.680
			300	34	3	6.4	20.6	---	---	---	---	---	---	---	---	---	---
			500	34	4	6.6	18.4	---	---	---	---	---	---	---	---	---	---
			690	34	4	6.9	17.3	36	53	5	---	65	.590	1.103	.141	---	1.320
			920	34	4	6.8	16.3	---	---	---	---	---	---	---	---	---	---
			1220	35	5	6.8	16.2	30	52	4	---	60	.492	1.083	.113	---	1.200
		West	300	34	4	6.7	16.1	---	---	---	---	---	---	---	---	---	---
			600	34	5	6.6	16.2	---	---	---	---	---	---	---	---	---	---
			900	34	10	6.8	17.7	---	---	---	---	---	---	---	---	---	---
			1100	34	30	7.0	22.9	56	61	7	---	81	.918	1.270	.197	---	1.620
			1300	34	23	7.3	24.5	85	43	7	---	92	1.393	.895	.197	---	1.840
Dec. 15--------	30,300	East	140	33	2	5.5	18.5	2	77	4	---	74	.033	1.603	.113	---	1.480
			300	33	3	5.7	18.2	---	---	---	---	---	---	---	---	---	---
			500	32	5	6.3	16.0	---	---	---	---	---	---	---	---	---	---
			690	32	8	6.6	14.1	22	47	2	---	51	.361	.979	.056	---	1.020
			920	32	5	6.5	13.7	---	---	---	---	---	---	---	---	---	---
			1220	33	4	6.7	12.8	24	42	5	---	48	.393	.874	.141	---	.960
		West	300	33	5	6.6	12.3	---	---	---	---	---	---	---	---	---	---
			600	32	5	6.6	12.1	---	---	---	---	---	---	---	---	---	---
			900	32	12	6.9	14.4	---	---	---	---	---	---	---	---	---	---
			1100	32	17	7.0	18.1	48	44	4	---	65	.787	.916	.113	---	1.320
			1300	32	12	7.3	18.2	64	29	4	---	72	1.049	.604	.113	---	1.440
Dec. 26--------	15,500	East	960	32	3	7.0	22.5	25	86	---	---	100	.410	1.791	---	---	2.000
			1220	32	6	7.0	20.3	26	77	---	---	86	.426	1.603	---	---	1.720
		West	200	32	5	7.1	18.5	---	---	---	---	---	---	---	---	---	---
			880	32	7	7.1	16.4	---	---	---	---	---	---	---	---	---	---
			1060	32	14	7.3	19.4	49	52	---	---	72	.803	1.083	---	---	1.440
			1260	32	23	7.5	24.7	86	55	7	---	94	1.409	1.145	.197	---	1.880

P 38.42
2.10

MERCE

ROCEDURE

a State Librar

Susquehanna River at Harrisburg, Pa.--Continued

Cross-section samples for water year ended September 30, 1945--Continued

Date	Discharge (second-feet)	Sampling point: Channel	Sampling point: Station	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Parts per million: Sulfate (SO_4)	Parts per million: Chloride (Cl)	Parts per million: Nitrate (NO_3)	Parts per million: Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Equivalents per million: Sulfate (SO_4)	Equivalents per million: Chloride (Cl)	Equivalents per million: Nitrate (NO_3)	Equivalents per million: Total hardness as $CaCO_3$
Jan. 5, 1945	50,500	East	500	32	3	6.5	16.2	14	60	5	---	69	0.229	1.249	0.141	---	1.380
			920	32	5	6.6	15.5	---	---	---	---	---	---	---	---	---	---
			1170	32	5	6.6	15.3	15	55	4	---	62	.246	1.145	.113	---	1.240
		West	340	32	7	6.6	13.7	---	---	---	---	---	---	---	---	---	---
			520	32	12	6.7	12.6	---	---	---	---	---	---	---	---	---	---
			980	32	8	6.6	11.2	---	---	---	---	---	---	---	---	---	---
			1050	32	8	6.7	11.5	18	40	3	---	48	.295	.833	.085	---	.960
			1300	32	15	7.1	15.0	42	35	4	---	57	.688	.729	.113	---	1.140
Jan. 15	19,600	East	1140	32	2	6.4	26.8	---	---	---	---	---	---	---	---	---	---
		West	300	32	3	6.3	24.9	---	---	---	---	---	---	---	---	---	---
			600	32	3	6.6	18.3	---	---	---	---	---	---	---	---	---	---
			900	32	3	6.8	14.4	---	---	---	---	---	---	---	---	---	---
			1100	32	4	6.9	15.0	---	---	---	---	---	---	---	---	---	---
			1300	32	7	7.1	21.2	---	---	---	---	---	---	---	---	---	---
Mar. 1	182,000	East	140	32	3	5.8	12.3	9	43	2.5	4.0	45	.148	.895	.071	0.064	.900
			480	32	4	5.8	11.6	---	---	---	---	---	---	---	---	---	---
			720	32	5	5.9	10.9	11	35	3	3.0	44	.180	.729	.085	.048	.880
			900	32	5	5.8	10.1	---	---	---	---	---	---	---	---	---	---
			1220	32	2	5.6	9.97	---	---	---	---	---	---	---	---	---	---
		West	320	32	1	5.3	10.1	---	---	---	---	---	---	---	---	---	---
			600	32	2	5.2	10.1	3	35	1.5	3.1	36	.049	.729	.042	.051	.720
			900	32	4	5.9	10.6	---	---	---	---	---	---	---	---	---	---
			1100	32	12	6.4	11.1	---	---	---	---	---	---	---	---	---	---
			1300	32	15	6.8	12.5	39	24	1.5	6.5	50	.639	.500	.042	.105	1.000
Mar. 9	214,000	East	140	36	5	6.0	11.9	12	39	2	3.2	44	.197	.812	.056	.052	.880
			300	37	6	6.0	11.6	---	---	---	---	---	---	---	---	---	---
			500	37	8	6.2	10.6	---	---	---	---	---	---	---	---	---	---
			690	38	9	6.3	10.8	16	29	1.5	2.7	39	.262	.604	.042	.044	.780
			920	38	6	6.1	8.92	---	---	---	---	---	---	---	---	---	---
			1220	38	5	5.8	7.67	---	---	---	---	---	---	---	---	---	---
		West	300	37	5	5.5	7.46	---	---	---	---	---	---	---	---	---	---
			600	38	6	5.2	7.56	4	26	1	1.1	27	.066	.541	.028	.018	.540
			900	39	10	6.3	8.90	---	---	---	---	---	---	---	---	---	---
			1100	39	17	6.6	11.0	---	---	---	---	---	---	---	---	---	---
			1300	39	23	6.9	12.0	38	23	1.5	5.6	51	.623	.479	.042	.090	1.020
Mar. 17	109,000	East	140	45	3	6.6	18.4	16	66	2	---	72	.262	1.374	.056	---	1.440
			690	44	7	6.9	13.8	28	37	2.5	---	54	.459	.770	.071	---	1.080
			1200	45	5	6.7	10.1	---	---	---	---	---	---	---	---	---	---
		West	600	46	2	5.8	9.20	4	35	1	---	36	.066	.729	.028	---	.720
			1100	48	6	7.1	12.3	---	---	---	---	---	---	---	---	---	---
			1300	50	17	7.4	15.8	59	28	3	---	64	.967	.583	.085	---	1.280
Mar. 26	125,000	East	120	46	8	6.4	13.2	15	44	1.5	2.7	51	.246	.916	.042	.044	1.020
			300	46	12	6.8	13.4	---	---	---	---	---	---	---	---	---	---
			500	46	12	6.7	11.0	---	---	---	---	---	---	---	---	---	---
			690	45	16	6.7	10.1	24	32	1	2.4	40	.393	.666	.028	.039	.800
			920	45	16	6.7	9.88	---	---	---	---	---	---	---	---	---	---
			1220	47	15	6.6	9.09	18	25	2	1.8	36	.295	.520	.056	.029	.720
		West	300	46	9	6.4	8.37	---	---	---	---	---	---	---	---	---	---
			600	47	6	6.2	8.02	7	29	1.5	1.2	33	.115	.604	.042	.019	.660
			900	47	4	6.2	8.06	---	---	---	---	---	---	---	---	---	---
			1100	47	7	6.6	8.52	---	---	---	---	---	---	---	---	---	---
			1300	50	13	7.1	13.1	44	24	1.5	3.1	58	.721	.500	.042	.050	1.160

Date	Discharge (second-feet)	Sampling point Channel	Sampling point Station	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Parts per million: Sulfate (SO_4)	Parts per million: Chloride (Cl)	Parts per million: Nitrate (NO_3)	Parts per million: Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Equivalents per million: Sulfate (SO_4)	Equivalents per million: Chloride (Cl)	Equivalents per million: Nitrate (NO_3)	Equivalents per million: Total hardness as $CaCO_3$
Apr. 6	83,700	East	120	50	3	5.8	19.3	4	77	3	2.6	81	0.066	1.603	0.085	0.042	1.620
			300	50	3	5.8	20.3	---	---	---	---	---	---	---	---	---	---
			500	51	6	6.4	18.0	---	---	---	---	---	---	---	---	---	---
			690	51	7	6.6	14.7	30	42	3	2.3	64	.492	.874	.085	.037	1.280
			920	51	6	6.7	13.3	---	---	---	---	---	---	---	---	---	---
			1220	54	6	6.5	11.6	12	40	3	1.7	50	.197	.833	.085	.027	1.000
		West	300	52	7	6.4	11.3	---	---	---	---	---	---	---	---	---	---
			600	52	12	6.7	11.1	22	33	2	1.8	45	.361	.687	.056	.029	.900
			900	52	28	7.0	12.8	---	---	---	---	---	---	---	---	---	---
			1100	52	30	6.9	12.8	42	27	2.5	3.3	67	.688	.562	.071	.053	1.140
			1300	52	20	7.1	17.9	76	21	2	6.6	81	1.246	.437	.056	.106	1.620
Apr. 16	31,600	East	140	58	2	5.9	27.6	4	123	3	1.1	114	.066	2.561	.085	.018	2.280
			300	59	1	6.1	27.1	---	---	---	---	---	---	---	---	---	---
			500	59	2	6.7	21.9	---	---	---	---	---	---	---	---	---	---
			690	59	6	7.0	19.2	30	60	3.5	2.4	81	.492	1.249	.099	.039	1.620
			920	59	7	6.9	15.7	---	---	---	---	---	---	---	---	---	---
			1220	60	5	6.8	11.7	12	42	3	1.2	48	.197	.874	.085	.019	.960
		West	300	59	4	6.7	11.2	---	---	---	---	---	---	---	---	---	---
			600	59	5	6.9	11.2	17	37	2.5	1.3	51	.279	.770	.071	.021	1.020
			900	59	7	7.2	14.6	---	---	---	---	---	---	---	---	---	---
			1100	59	11	7.3	16.0	53	30	3	2.8	64	.869	.625	.085	.045	1.280
			1300	58	8	7.4	26.1	128	20	4	7.2	120	2.098	.416	.113	.116	2.400
Apr. 26	31,600	East	140	54	2	6.2	29.0	5	124	4	1.0	123	.082	2.582	.113	.016	2.460
			300	55	2	6.7	30.3	---	---	---	---	---	---	---	---	---	---
			500	55	4	6.9	25.7	---	---	---	---	---	---	---	---	---	---
			690	55	5	7.1	19.3	26	63	4	1.2	81	.426	1.312	.113	.019	1.620
			920	54	5	6.8	13.7	---	---	---	---	---	---	---	---	---	---
			1220	55	7	6.7	12.2	10	45	3	.8	50	.164	.937	.085	.013	1.000
		West	300	55	7	6.9	12.2	---	---	---	---	---	---	---	---	---	---
			600	55	12	7.2	14.2	38	33	3.5	2.1	58	.623	.687	.099	.034	1.160
			900	55	27	7.3	17.2	50	32	8.5	1.6	72	.820	.666	.240	.026	1.140
			1100	55	28	7.2	14.1	---	---	---	---	---	---	---	---	---	---
			1300	55	8	7.6	24.6	124	19	3.5	6.6	123	2.032	.396	.099	.106	2.460
May 4	59,800	East	140	49	1	6.1	18.4	8	73	2	1.5	82	.131	1.520	.056	.024	1.640
			300	49	2	6.2	18.0	---	---	---	---	---	---	---	---	---	---
			500	49	6	6.5	15.2	---	---	---	---	---	---	---	---	---	---
			690	49	8	6.9	13.3	25	38	1.5	1.5	60	.410	.791	.042	.024	1.200
			920	49	10	6.7	12.2	---	---	---	---	---	---	---	---	---	---
			1220	50	7	6.6	9.61	14	30	2	1.1	42	.230	.625	.056	.018	.840
		West	300	50	5	6.5	8.64	---	---	---	---	---	---	---	---	---	---
			600	50	3	6.5	8.35	10	28	1.5	.7	34	.164	.583	.042	.011	.680
			900	50	2	6.8	10.0	---	---	---	---	---	---	---	---	---	---
			1100	51	15	7.1	13.0	42	26	2	1.7	57	.688	.541	.056	.027	1.140
			1300	51	8	7.3	16.1	67	24	2.5	4.1	74	1.098	.500	.071	.066	1.480
May 15	91,100	East	140	57	2	6.4	16.2	12	59	1.5	1.2	66	.197	1.228	.042	.019	1.320
			300	56	4	6.5	15.3	---	---	---	---	---	---	---	---	---	---
			500	56	10	6.6	13.1	---	---	---	---	---	---	---	---	---	---
			690	56	17	6.7	11.6	27	31	1.5	1.4	51	.443	.645	.042	.023	1.020
			920	56	13	6.7	11.0	---	---	---	---	---	---	---	---	---	---
			1220	57	8	6.7	9.48	16	28	1.5	1.0	40	.262	.583	.042	.016	.800
		West	300	57	4	6.5	8.53	---	---	---	---	---	---	---	---	---	---
			600	57	5	6.4	8.01	8	28	1.5	.5	33	.131	.583	.042	.008	.660
			900	57	4	6.6	8.75	---	---	---	---	---	---	---	---	---	---
			1100	59	7	7.0	11.2	30	26	1.5	1.2	52	.492	.541	.042	.019	1.040
			1300	61	10	7.1	14.0	48	24	2	2.4	64	.787	.500	.056	.039	1.280

PROCEDURE
MERCE
a State Libra

Susquehanna River at Harrisburg, Pa.--Continued

Cross-section samples for water year ended September 30, 1945--Continued

Date	Discharge (second-feet)	Sampling point Channel	Sampling point Station	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Parts per million: Sulfate (SO_4)	Parts per million: Chloride (Cl)	Parts per million: Nitrate (NO_3)	Parts per million: Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Equivalents per million: Sulfate (SO_4)	Equivalents per million: Chloride (Cl)	Equivalents per million: Nitrate (NO_3)	Equivalents per million: Total hardness as $CaCO_3$
May 25	50,300	East	140	61	2	6.1	20.6	8	79	1.5	2.4	66	0.131	1.645	0.042	0.039	1.720
			300	62	3	6.3	19.3	---	---	---	---	---	---	---	---	---	---
			500	62	5	6.5	16.4	---	---	---	---	---	---	---	---	---	---
			690	62	5	6.7	14.5	33	39	1	2.1	52	.541	.812	.028	.034	1.040
			920	62	5	6.6	13.5	---	---	---	---	---	---	---	---	---	---
			1220	62	6	6.5	10.4	17	30	1	1.6	42	.279	.625	.028	.026	.840
		West	300	62	5	6.3	9.56	---	---	---	---	---	---	---	---	---	---
			600	62	4	6.3	9.24	9	33	1	1.2	33	.147	.687	.028	.019	.660
			900	62	8	6.7	10.9	---	---	---	---	---	---	---	---	---	---
			1100	62	10	7.0	14.6	49	26	1.5	2.8	52	.803	.541	.042	.045	1.040
			1300	62	14	7.0	17.2	68	25	2.5	4.8	66	1.114	.521	.070	.077	1.320
June 5	59,800	East	140	57	2	6.2	23.4	12	92	2.5	2.2	90	.197	1.915	.070	.036	1.800
			300	57	2	6.5	23.0	---	---	---	---	---	---	---	---	---	---
			500	56	4	6.6	19.3	---	---	---	---	---	---	---	---	---	---
			690	56	4	6.5	13.2	21	39	2	2.1	51	.344	.812	.056	.034	1.020
			920	55	10	6.4	9.79	---	---	---	---	---	---	---	---	---	---
			1220	55	7	6.3	7.99	9	27	1.5	1.5	30	.147	.562	.042	.024	.600
		West	300	55	8	6.3	8.21	---	---	---	---	---	---	---	---	---	---
			600	55	9	6.3	8.46	12	29	1	1.0	30	.197	.604	.028	.016	.600
			900	55	7	6.6	9.50	---	---	---	---	---	---	---	---	---	---
			1100	57	9	6.8	13.4	42	26	2	2.5	51	.688	.541	.056	.040	1.020
			1300	60	6	7.3	20.6	90	24	3	5.6	80	1.475	.500	.085	.090	1.600
June 15	26,700	East	140	76	2	5.6	32.6	3	137	2	2.6	130	.049	2.852	.056	.042	2.600
			300	76	2	6.0	30.1	---	---	---	---	---	---	---	---	---	---
			500	76	3	6.8	24.3	---	---	---	---	---	---	---	---	---	---
			690	76	5	6.9	21.1	32	67	3	1.4	69	.524	1.395	.085	.023	1.380
			920	76	4	6.9	18.8	---	---	---	---	---	---	---	---	---	---
			1220	75	3	6.7	13.4	18	44	1.5	1.6	52	.295	.916	.042	.026	1.040
		West	300	76	4	6.9	12.1	---	---	---	---	---	---	---	---	---	---
			600	76	5	6.8	11.4	18	34	1	1.4	42	.295	.708	.028	.023	.840
			900	77	7	7.2	14.2	---	---	---	---	---	---	---	---	---	---
			1100	78	10	7.2	18.8	66	32	3	2.0	69	1.082	.666	.085	.032	1.380
			1300	79	10	7.4	22.9	102	25	4.5	4.3	96	1.672	.521	.127	.069	1.920
June 25	25,300	East	140	78	2	6.0	28.7	6	118	3.5	3.4	118	.098	2.457	.099	.055	2.360
			300	78	3	6.2	26.3	---	---	---	---	---	---	---	---	---	---
			500	78	5	6.6	20.6	---	---	---	---	---	---	---	---	---	---
			690	78	7	6.8	18.7	33	54	2.5	2.8	74	.541	1.124	.070	.045	1.480
			920	77	6	7.0	18.0	---	---	---	---	---	---	---	---	---	---
			1220	78	5	6.9	16.8	30	50	2.5	2.2	66	.492	1.041	.070	.036	1.320
		West	300	79	8	6.8	16.2	---	---	---	---	---	---	---	---	---	---
			600	79	5	6.8	14.9	22	45	1.5	1.1	63	.361	.937	.042	.018	1.260
			900	79	7	6.9	15.8	---	---	---	---	---	---	---	---	---	---
			1100	80	8	7.1	19.5	60	40	3	2.1	66	.983	.833	.085	.034	1.320
			1300	80	5	7.5	23.1	97	28	4	3.7	96	1.590	.583	.113	.060	1.920
July 5	14,300	East	140	75	3	6.4	37.6	4	164	3	.8	174	.066	3.415	.085	.013	3.480
			300	75	2	6.3	35.4	---	---	---	---	---	---	---	---	---	---
			500	75	5	6.6	29.2	---	---	---	---	---	---	---	---	---	---
			690	75	7	6.8	25.1	36	81	3.5	1.0	108	.590	1.686	.099	.016	2.160
			920	75	6	6.8	22.8	---	---	---	---	---	---	---	---	---	---
			1220	75	8	6.6	19.2	24	63	2.5	1.9	72	.393	1.312	.070	.031	1.440
		West	300	75	5	6.7	17.8	---	---	---	---	---	---	---	---	---	---
			600	75	6	6.6	16.5	21	54	3	2.1	63	.344	1.124	.085	.034	1.260
			900	75	7	7.0	17.0	---	---	---	---	---	---	---	---	---	---
			1100	76	9	7.1	21.7	60	47	3.5	3.5	88	.984	.979	.099	.056	1.760

Date	Discharge (second-feet)	Sampling point. Channel Station	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Parts per million: Sulfate (SO_4)	Parts per million: Chloride (Cl)	Parts per million: Nitrate (NO_3)	Parts per million: Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Equivalents per million: Sulfate (SO_4)	Equivalents per million: Chloride (Cl)	Equivalents per million: Nitrate (NO_3)	Equivalents per million: Total hardness as $CaCO_3$
July 13	10,700	East 140	---	2	4.6	45.6	[a]0	205	5	1.5	207	0.000	4.269	0.141	0.024	4.140
		300	74	5	5.0	43.2	---	---	---	---	---	---	---	---	---	---
		500	74	7	5.4	35.1	---	---	---	---	---	---	---	---	---	---
		690	75	5	5.7	28.9	33	98	4.5	1.9	105	.541	2.040	.127	.031	2.100
		920	74	8	6.7	24.4	---	---	---	---	---	---	---	---	---	---
		1220	74	10	6.8	19.6	---	---	---	---	---	---	---	---	---	---
		West 300	75	10	7.0	19.5	---	---	---	---	---	---	---	---	---	---
		600	75	8	7.1	19.5	25	45	3.5	1.4	69	.410	.937	.099	.023	1.380
		900	76	10	7.4	23.7	---	---	---	---	---	---	---	---	---	---
		1100	76	10	7.5	26.8	100	44	5	1.9	102	1.639	.916	.141	.031	2.040
		1300	76	9	7.7	26.3	121	25	6.5	4.6	120	1.983	.521	.183	.074	2.400
July 25	18,400	East 140	72	5	4.3	29.1	[b]0	124	2.5	1.9	93	.000	2.582	.070	.031	1.860
		300	74	5	4.1	37.1	---	---	---	---	---	---	---	---	---	---
		500	74	4	4.15	37.9	[c]0	164	2.5	1.0	150	.000	3.415	.070	.016	3.000
		690	76	4	4.45	31.9	---	---	---	---	---	---	---	---	---	---
		920	76	5	4.8	29.1	[a]0	121	3	1.4	105	.000	2.519	.085	.023	2.100
		1220	76	7	5.0	25.3	5	105	3	2.3	116	.082	2.144	.085	.037	2.320
		West 300	76	5	6.3	24.1	---	---	---	---	---	---	---	---	---	---
		600	76	5	6.6	21.7	14	81	4	2.4	92	.229	1.686	.113	.039	1.840
		900	76	7	6.8	20.2	---	---	---	---	---	---	---	---	---	---
		1100	77	8	7.3	23.9	66	51	6.5	2.0	98	1.082	1.062	.183	.032	1.960
		1300	77	10	7.5	28.6	115	36	8	3.4	123	1.885	.750	.226	.055	2.460
Aug. 3	31,000	East 140	73	5	4.45	30.0	[d]0	134	3	1.4	114	.000	2.790	.085	.023	2.280
		300	74	4	4.6	29.2	---	---	---	---	---	---	---	---	---	---
		500	74	5	6.1	22.0	---	---	---	---	---	---	---	---	---	---
		690	74	5	6.6	19.4	20	70	2	2.3	82	.328	1.457	.056	.037	1.640
		920	75	7	6.7	17.9	---	---	---	---	---	---	---	---	---	---
		1220	74	9	6.8	16.7	---	---	---	---	---	---	---	---	---	---
		West 300	75	10	6.8	16.1	22	52	2.5	2.2	58	.361	1.083	.070	.036	1.160
		600	75	10	6.9	16.6	---	---	---	---	---	---	---	---	---	---
		900	76	35	7.2	22.0	68	48	5	2.4	80	1.114	.999	.141	.039	1.600
		1100	74	30	7.1	20.2	74	36	4	3.4	78	1.213	.750	.113	.055	1.560
		1300	73	36	7.2	21.6	98	26	2	3.6	99	1.606	.541	.056	.139	1.980
Aug. 20	7,020	East 140	75	3	4.3	57.7	[b]0	282	3	.8	261	.000	5.871	.085	.013	5.220
		300	75	2	4.4	56.6	---	---	---	---	---	---	---	---	---	---
		500	75	5	4.6	47.6	---	---	---	---	---	---	---	---	---	---
		690	75	4	6.5	37.2	10	162	3	1.0	174	.164	3.373	.085	.016	3.480
		920	74	7	7.0	30.9	---	---	---	---	---	---	---	---	---	---
		1220	74	5	7.2	24.6	19	93	3.5	1.0	114	.311	1.936	.099	.016	2.280
		West 300	75	8	7.2	23.0	---	---	---	---	---	---	---	---	---	---
		600	75	7	7.3	21.2	28	73	4	.8	87	.459	1.520	.113	.013	1.740
		900	75	10	8.0	23.6	---	---	---	---	---	---	---	---	---	---
		1100	75	10	8.6	25.7	86	51	6	.2	96	1.409	1.062	.169	.003	1.920
		1300	75	8	7.9	20.5	93	22	5.5	3.1	100	1.524	.458	.155	.050	2.000
Aug. 27	18,200	East 140	62	2	4.5	24.8	[a]0	98	2	5.2	105	.000	2.040	.056	.084	2.100
		300	63	3	4.2	32.7	[c]0	134	3	5.0	141	.000	2.790	.085	.081	2.820
		500	64	3	4.4	41.2	[d]0	184	4	2.2	192	.000	3.831	.113	.036	3.840
		690	64	2	5.9	37.3	11	160	5	2.0	174	.180	3.331	.141	.032	3.480
		920	64	2	6.6	22.7	---	---	---	---	---	---	---	---	---	---
		1220	64	4	6.8	19.3	38	49	5	2.4	72	.623	1.020	.141	.039	1.440
		West 300	64	9	6.8	17.1	43	38	4	3.2	70	.705	.791	.113	.052	1.400
		600	65	18	6.9	23.9	---	---	---	---	---	---	---	---	---	---
		900	65	22	7.1	27.0	100	42	8	3.2	111	1.639	.874	.226	.052	2.220
		1100	65	13	7.0	28.9	---	---	---	---	---	---	---	---	---	---
		1300	---	13	7.2	28.2	132	13	4	7.0	120	2.164	.396	.113	.113	2.400

[a]Free acid as H_2SO_4 = 0. [b]Free acid as H_2SO_4 = 2. [c]Free acid as H_2SO_4 = 3. [d]Free acid as H_2SO_4 = 1.

a State Librar
NTS SECTION
ROCEDURE
MERCE
P38.49
2.10

Susquehanna River at Harrisburg, Pa.—Continued

Cross-section samples for water year ended September 30, 1945--Continued

Date	Discharge (second-feet)	Sampling point: Channel	Sampling point: Station	Temperature (°F.)	Color	pH	Specific conductance (Kx10^6 at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Parts per million: Sulfate (SO_4)	Parts per million: Chloride (Cl)	Parts per million: Nitrate (NO_3)	Parts per million: Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Equivalents per million: Sulfate (SO_4)	Equivalents per million: Chloride (Cl)	Equivalents per million: Nitrate (NO_3)	Equivalents per million: Total hardness as $CaCO_3$
Sept. 4	12,000	East	140	71	1	3.8	57.6	[e] 0	268	5	0.7	228	0.000	5.580	0.141	0.011	4.560
			300	72	---	3.9	60.5	---	---	---	---	---	---	---	---	---	---
			500	72	5	4.1	55.0	---	---	---	---	---	---	---	---	---	---
			690	72	5	4.9	41.0	[a] 5	181	5	1.2	168	.082	3.768	.141	.019	3.360
			970	71	5	6.5	30.7	---	---	---	---	---	---	---	---	---	---
			1220	71	5	6.7	26.0	32	90	5	1.7	108	.524	1.874	.141	.027	2.160
		West	300	71	5	6.8	23.8	---	---	---	---	---	---	---	---	---	---
			600	72	5	6.9	21.6	43	61	5	1.6	90	.705	1.270	.141	.026	1.800
			900	73	6	7.0	23.9	---	---	---	---	---	---	---	---	---	---
			1100	73	10	7.3	25.0	92	47	6	1.9	114	1.508	.979	.169	.031	2.280
			1300	72	10	7.3	27.0	129	25	6	6	129	2.114	.521	.169	.097	2.580
Sept. 18	19,500	East	140	59	5	4.8	27.7	[a] 2	117	3	3	114	.033	2.436	.085	.048	2.280
			300	60	5	4.8	32.8	---	---	---	---	---	---	---	---	---	---
			500	61	5	6.2	31.3	---	---	---	---	---	---	---	---	---	---
			690	61	5	6.7	24.8	30	80	6	2.2	102	.492	1.666	.169	.036	2.040
			920	61	7	6.7	18.2	---	---	---	---	---	---	---	---	---	---
			1220	60	30	6.7	13.1	37	30	2	4.7	54	.606	.625	.056	.076	1.080
		West	300	59	35	6.7	14.7	---	---	---	---	---	---	---	---	---	---
			600	59	35	6.7	13.5	---	---	---	---	---	---	---	---	---	---
			900	58	35	6.5	9.36	31	14	1	5.8	45	.508	.291	.028	.094	.900
			1100	58	40	7.1	18.2	---	---	---	---	---	---	---	---	---	---
			1300	59	40	7.2	19.0	93	25	1	8.2	90	1.524	.521	.028	.132	1.800
Sept. 25	32,800	East	140	63	1	4.9	25.4	5	108	2	1.7	102	.082	2.249	.056	.027	2.040
			300	63	5	4.9	24.5	---	---	---	---	---	---	---	---	---	---
			500	63	10	6.1	18.4	---	---	---	---	---	---	---	---	---	---
			690	64	10	6.4	16.1	23	56	2	2	60	.377	1.166	.056	.032	1.200
			920	63	10	6.5	14.5	---	---	---	---	---	---	---	---	---	---
			1220	63	10	6.5	13.5	22	43	2	2.1	51	.361	.895	.056	.034	1.020
		West	300	63	5	6.6	12.9	---	---	---	---	---	---	---	---	---	---
			600	63	5	6.5	12.9	19	45	2	2.1	45	.311	.937	.056	.034	.900
			900	64	10	6.8	15.9	---	---	---	---	---	---	---	---	---	---
			1100	64	20	7.0	17.4	54	36	2	4.3	69	.885	.750	.056	.069	1.380
			1300	63	10	7.4	26.0	121	27	3	10	105	1.983	.562	.085	.161	2.100

[a] Free acid as H_2SO_4 = 0.

[e] Free acid as H_2SO_4 = 8.

Susquehanna River at Harrisburg

Cross-section samples for water year ended September 30, 1946

Date	Discharge (second-feet)	Sampling point: Channel	Sampling point: Station	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Parts per million: Sulfate (SO_4)	Parts per million: Chloride (Cl)	Parts per million: Nitrate (NO_3)	Parts per million: Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Equivalents per million: Sulfate (SO_4)	Equivalents per million: Chloride (Cl)	Equivalents per million: Nitrate (NO_3)	Equivalents per million: Total hardness as $CaCO_3$
Oct. 5, 1945	73,300	East	140	54	1	6.1	26.4	9	107	2	2.3	117	0.147	2.228	0.056	0.037	2.340
			300	54	5	6.2	25.6	---	---	---	---	---	---	---	---	---	---
			500	55	5	6.4	23.4	---	---	---	---	---	---	---	---	---	---
			690	54	5	6.6	21.1	26	73	2	2.3	81	.426	1.520	.056	.037	1.620
			920	54	10	6.6	17.4	---	---	---	---	---	---	---	---	---	---
			1220	55	10	6.5	12.8	15	44	1	1.8	48	.246	.916	.028	.029	.960
		West	300	54	10	6.4	11.3	---	---	---	---	---	---	---	---	---	---
			600	54	5	6.2	10.2	10	37	1	1.2	45	.164	.770	.028	.019	.900
			900	54	5	6.4	10.8	---	---	---	---	---	---	---	---	---	---
			1100	54	10	6.8	13.5	34	37	2	1.8	54	.557	.770	.056	.029	1.080
			1300	54	10	7.1	19.2	70	36	2	3.1	75	1.147	.750	.056	.050	1.500
Oct. 16	32,900	East	140	48	1	5.7	26.6	4	111	2	1.2	114	.066	2.311	.056	.019	2.280
			300	49	1	6.0	24.6	---	---	---	---	---	---	---	---	---	---
			500	49	5	6.4	19.8	---	---	---	---	---	---	---	---	---	---
			690	49	10	6.6	17.4	32	53	2	1.2	68	.524	1.103	.056	.019	1.360
			920	49	10	6.8	16.4	---	---	---	---	---	---	---	---	---	---
			1220	50	10	6.7	14.5	28	41	2	1.4	54	.459	.854	.056	.023	1.080
		West	300	49	10	6.7	13.6	---	---	---	---	---	---	---	---	---	---
			600	49	5	6.6	12.3	21	37	2	1.1	51	.344	.770	.056	.018	1.020
			900	49	5	6.8	12.4	---	---	---	---	---	---	---	---	---	---
			1100	49	10	7.0	17.0	52	37	3	3.0	75	.852	.770	.085	.048	1.500
			1300	48	10	7.1	23.6	88	36	4	4.7	87	1.442	.750	.113	.076	1.740
Oct. 25	16,400	East	140	53	1	5.4	35.9	3	157	4	.8	162	.049	3.269	.113	.013	3.240
			300	53	1	5.9	33.3	---	---	---	---	---	---	---	---	---	---
			500	53	5	6.5	27.0	---	---	---	---	---	---	---	---	---	---
			690	53	5	6.8	23.4	38	73	3	1.8	102	.623	1.520	.085	.029	2.040
			920	53	5	6.8	21.4	---	---	---	---	---	---	---	---	---	---
			1220	54	5	6.8	18.4	33	55	4	1.3	70	.541	1.145	.113	.021	1.400
		West	300	53	5	6.9	17.0	---	---	---	---	---	---	---	---	---	---
			600	53	5	6.9	15.5	36	44	3	1.2	75	.590	.916	.085	.019	1.500
			900	54	10	6.9	17.0	---	---	---	---	---	---	---	---	---	---
			1100	54	25	7.1	23.3	76	46	4	2.3	87	1.246	.958	.113	.037	1.740
			1300	54	15	7.4	30.2	133	34	6	4.8	150	2.180	.708	.169	.077	3.000
Nov. 5	45,800	East	140	46	5	5.9	30.7	9	128	3	.9	132	.147	2.665	.085	.015	2.640
			300	46	5	6.1	28.3	---	---	---	---	---	---	---	---	---	---
			500	47	6	6.4	24.5	---	---	---	---	---	---	---	---	---	---
			690	47	6	6.7	21.1	38	65	3	1.6	84	.623	1.353	.085	.026	1.680
			920	46	10	6.7	19.2	---	---	---	---	---	---	---	---	---	---
			1220	48	10	6.6	16.1	30	45	3	2.1	66	.492	.937	.085	.034	1.320
		West	300	47	10	6.5	14.4	---	---	---	---	---	---	---	---	---	---
			600	47	10	6.4	13.0	20	38	3	1.4	80	.328	.791	.085	.023	1.000
			900	47	10	6.6	13.6	---	---	---	---	---	---	---	---	---	---
			1100	47	15	6.8	17.8	50	39	3	2.5	69	.919	.812	.085	.040	1.380
			1300	46	15	7.3	26.4	102	47	4	3.6	126	1.672	.979	.113	.058	2.520
Dec. 3	86,500	East	140	36	3	6.1	17.1	9	67	2	2.7	69	.147	1.395	.056	.044	1.380
			300	36	5	6.2	16.7	---	---	---	---	---	---	---	---	---	---
			500	36	8	6.3	14.8	---	---	---	---	---	---	---	---	---	---
			690	36	8	6.3	12.4	22	33	1	2.0	52	.361	.687	.028	.032	1.040
			920	37	8	6.5	11.1	---	---	---	---	---	---	---	---	---	---
			1220	40	6	6.1	8.91	9.4	33	2	1.5	40	.154	.687	.056	.024	.800
		West	300	38	5	6.0	8.73	---	---	---	---	---	---	---	---	---	---
			600	38	5	6.6	9.19	18	27	2	2.0	45	.295	.562	.056	.032	.900
			900	39	10	6.9	11.5	---	---	---	---	---	---	---	---	---	---
			1100	39	18	7.0	13.4	44	29	2	3.8	60	.721	.604	.056	.061	1.200
			1300	39	16	7.3	17.1	66	19	2	6.8	81	1.082	.396	.056	.110	1.620

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Susquehanna River at Harrisburg- Continued

Cross-section samples for water year ended September 30, 1946--Continued

Date	Discharge (second-feet)	Sampling point: Channel	Sampling point: Station	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Parts per million: Sulfate (SO_4)	Parts per million: Chloride (Cl)	Parts per million: Nitrate (NO_3)	Parts per million: Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Equivalents per million: Sulfate (SO_4)	Equivalents per million: Chloride (Cl)	Equivalents per million: Nitrate (NO_3)	Equivalents per million: Total hardness as $CaCO_3$
Dec. 14----------	43,300	East	140	34	4	5.6	21.6	4	88	3	1.9	92	0.066	1.832	0.085	0.031	1.840
			300	34	4	6.3	22.0	---	---	---	---	---	---	---	---	---	---
			500	35	3	6.3	17.7	---	---	---	---	---	---	---	---	---	---
			690	35	4	6.5	15.3	28	40	2	2.0	64	.459	.833	.056	.032	1.280
			920	37	5	6.4	13.8	---	---	---	---	---	---	---	---	---	---
			1220	38	5	6.4	11.5	16	34	2	1.7	51	.262	.708	.056	.027	1.020
		West	300	32	3	5.8	11.0	---	---	---	---	---	---	---	---	---	---
			600	32	4	6.6	10.5	16	32	3	1.7	48	.262	.666	.085	.027	.960
			900	33	5	6.7	13.3	---	---	---	---	---	---	---	---	---	---
			1100	33	5	6.9	16.6	56	30	3	3.4	66	.918	.625	.085	.055	1.320
			1300	34	5	7.5	26.3	124	23	4	7.1	117	2.032	.479	.113	.114	2.340
Jan. 8, 1946-----	128,000	East	140	38	3	6.4	17.9	25	53	4	2.5	72	.410	1.103	.113	.040	1.440
			300	41	4	5.9	20.8	---	---	---	---	---	---	---	---	---	---
			500	41	4	5.6	19.2	---	---	---	---	---	---	---	---	---	---
			690	40	4	6.2	21.0	19	47	4	2.5	71	.311	.979	.113	.040	1.420
			920	38	5	6.3	15.3	---	---	---	---	---	---	---	---	---	---
			1220	37	4	6.2	12.1	17	37	2	1.9	39	.279	.770	.056	.031	.780
		West	300	37	4	6.4	12.0	---	---	---	---	---	---	---	---	---	---
			600	35	3	6.4	11.8	24	29	4	2.8	54	.393	.604	.113	.045	1.080
			900	33	8	6.5	13.2	---	---	---	---	---	---	---	---	---	---
			1100	33	8	6.6	12.8	40	22	3	3.2	54	.656	.458	.085	.052	1.080
			1300	35	12	6.9	13.1	48	21	3	4.6	57	.787	.437	.085	.074	1.140
Jan. 15----------	67,600	East	140	33	4	6.0	18.8	8	72	2	2.8	81	.131	1.499	.056	.045	1.620
			300	33	3	6.0	17.6	---	---	---	---	---	---	---	---	---	---
			500	33	3	6.4	14.6	---	---	---	---	---	---	---	---	---	---
			690	33	5	6.5	12.0	22	28	2	2.3	51	.361	.583	.056	.037	1.020
			930	33	5	6.4	10.9	---	---	---	---	---	---	---	---	---	---
			1220	35	3	6.1	8.28	8	25	2	1.8	33	.131	.521	.056	.029	.660
		West	300	34	4	6.0	8.00	---	---	---	---	---	---	---	---	---	---
			600	34	3	6.2	8.15	8	24	2	1.6	33	.131	.500	.056	.026	.660
			900	34	5	6.5	11.5	---	---	---	---	---	---	---	---	---	---
			1100	34	5	6.7	13.6	42	23	2	3.6	54	.688	.479	.056	.058	1.080
			1300	34	4	7.0	16.6	64	20	2	5.1	69	1.049	.416	.056	.082	1.380
Mar. 4----------	73,300	East	140	36	5	6.1	18.3	18	58	4	4.2	74	.295	1.208	.113	.068	1.480
			300	36	5	6.2	18.0	---	---	---	---	---	---	---	---	---	---
			500	36	5	6.3	16.4	---	---	---	---	---	---	---	---	---	---
			690	37	7	6.3	14.8	32	34	5	4.2	58	.524	.708	.141	.068	1.160
			920	36	10	6.3	13.5	---	---	---	---	---	---	---	---	---	---
			1220	36	7	6.2	10.4	15	30	2	3.0	42	.246	.625	.056	.048	.840
		West	300	36	5	6.1	8.46	---	---	---	---	---	---	---	---	---	---
			600	36	5	6.0	8.06	6	29	2	2.2	36	.098	.604	.056	.035	.720
			900	38	15	6.3	9.86	---	---	---	---	---	---	---	---	---	---
			1100	39	27	6.6	12.1	33	33	2	4.0	54	.541	.687	.056	.065	1.080
			1300	39	23	7.0	15.0	55	26	2	6.6	69	.901	.541	.056	.106	1.380
Mar. 14----------	86,500	East	140	43	5	6.0	14.1	6	56	2	2.6	57	.098	1.166	.056	.042	1.140
			300	42	5	6.1	13.0	---	---	---	---	---	---	---	---	---	---
			500	42	7	6.3	11.6	---	---	---	---	---	---	---	---	---	---
			690	42	7	6.5	10.1	19	38	2	2.9	51	.311	.791	.056	.047	1.020
			920	42	10	6.4	10.1	---	---	---	---	---	---	---	---	---	---
			1220	43	7	6.5	8.56	14	34	2	2.2	42	.229	.708	.056	.035	.840
		West	300	43	5	6.5	8.29	---	---	---	---	---	---	---	---	---	---
			600	44	5	6.4	7.79	9	28	2	1.5	33	.147	.583	.056	.024	.660
			900	45	7	6.6	9.16	---	---	---	---	---	---	---	---	---	---
			1100	46	7	6.9	11.0	31	35	2	3.2	51	.508	.729	.056	.052	1.020
			1300	47	7	7.1	14.3	51	36	3	5.7	69	.836	.749	.085	.092	1.380

Cross-section samples for water year ended September 30, 1946--Continued

Date	Discharge (second-feet)	Sampling point: Channel	Sampling point: Station	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Parts per million: Sulfate (SO_4)	Parts per million: Chloride (Cl)	Parts per million: Nitrate (NO_3)	Parts per million: Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Equivalents per million: Sulfate (SO_4)	Equivalents per million: Chloride (Cl)	Equivalents per million: Nitrate (NO_3)	Equivalents per million: Total hardness as $CaCO_3$
Mar. 25	47,600	East	140	45	2	6.2	20.5	8	79	3	2.6	80	0.131	1.645	0.085	0.042	1.600
			300	46	2	6.3	19.8	---	---	---	---	---	---	---	---	---	---
			500	46	4	6.6	17.5	---	---	---	---	---	---	---	---	---	---
			690	46	6	6.9	15.2	28	44	3	2.8	64	.459	.916	.085	.045	1.280
			820	46	4	6.7	13.1	---	---	---	---	---	---	---	---	---	---
			1220	47	4	6.8	9.83	13	31	2	1.8	40	.213	.645	.056	.026	.800
		West	300	45	2	6.6	9.19	---	---	---	---	---	---	---	---	---	---
			600	46	2	7.0	9.66	18	26	1	1.8	40	.295	.541	.028	.026	.800
			900	46	6	7.0	12.8	---	---	---	---	---	---	---	---	---	---
			1130	46	9	7.2	13.8	49	23	3	3.1	62	.803	.479	.085	.050	1.240
			1300	46	9	7.3	18.8	84	20	2	5.7	81	1.377	.416	.056	.092	1.620
Apr. 6	29,100	East	140	47	12	6.2	26.8	8	107	4	2.0	104	.131	2.228	.113	.032	2.080
			300	48	10	6.2	26.6	---	---	---	---	---	---	---	---	---	---
			500	48	14	6.6	23.5	---	---	---	---	---	---	---	---	---	---
			690	48	10	6.7	18.4	30	48	4	2.9	76	.492	.999	.113	.047	1.520
			920	47	10	6.5	18.2	---	---	---	---	---	---	---	---	---	---
			1220	49	10	6.6	12.0	15	32	4	1.4	48	.246	.666	.113	.023	.960
		West	300	47	8	6.7	11.7	---	---	---	---	---	---	---	---	---	---
			600	47	10	6.8	11.9	26	27	4	1.9	45	.426	.562	.113	.031	.900
			900	48	20	7.1	15.9	---	---	---	---	---	---	---	---	---	---
			1130	48	20	7.1	16.0	56	24	3	3.8	69	.918	.500	.085	.058	1.380
			1300	48	15	7.6	23.3	112	17	4	6.2	108	1.836	.354	.113	.100	2.160
Apr. 13	18,000	East	140	53	7	6.0	34.1	8	140	6	2.9	144	.131	2.915	.169	.047	2.880
			300	53	7	6.3	33.4	---	---	---	---	---	---	---	---	---	---
			500	54	8	6.6	28.9	---	---	---	---	---	---	---	---	---	---
			690	54	8	6.6	24.1	38	69	8	2.9	102	.623	1.437	.226	.047	2.040
			920	54	7	6.7	19.8	---	---	---	---	---	---	---	---	---	---
			1220	54	7	6.5	14.6	20	43	4	1.8	66	.328	.895	.113	.029	1.320
		West	300	53	8	6.5	13.9	---	---	---	---	---	---	---	---	---	---
			600	54	6	6.7	14.5	34	35	4	1.7	63	.557	.729	.113	.027	1.260
			900	54	12	6.9	19.0	---	---	---	---	---	---	---	---	---	---
			1130	54	13	7.1	18.7	76	30	4	2.8	87	1.246	.625	.113	.045	1.740
			1300	54	8	7.4	24.2	136	18	4	6.8	132	2.229	.375	.113	.110	2.640
Apr. 23	14,300	East	140	64	0	6.2	35.3	15	149	2	2.3	147	.246	3.102	.056	.037	2.940
			300	64	1	6.4	34.3	---	---	---	---	---	---	---	---	---	---
			500	65	1	6.7	28.6	---	---	---	---	---	---	---	---	---	---
			690	64	0	6.9	24.6	44	72	4	2.0	102	.721	1.499	.113	.032	2.040
			920	64	0	6.8	21.0	---	---	---	---	---	---	---	---	---	---
			1220	65	1	7.4	18.8	30	56	5	1.0	78	.490	1.166	.141	.016	1.560
		West	300	64	0	6.9	16.5	---	---	---	---	---	---	---	---	---	---
			600	64	0	6.9	17.3	32	46	4	1.4	84	.525	.958	.113	.023	1.680
			900	61	6	7.1	21.8	---	---	---	---	---	---	---	---	---	---
			1130	62	6	7.4	22.4	82	37	4	2.9	90	1.344	.770	.113	.060	1.800
			1300	62	1	7.8	30.4	102	51	4	4.1	134	1.672	.437	.113	.066	2.680
May 3	12,300	East	140	57	3	6.4	27.1	12	119	4	1.4	120	.197	2.481	.169	.023	2.400
			300	57	2	6.5	26.6	---	---	---	---	---	---	---	---	---	---
			500	56	3	6.7	20.0	---	---	---	---	---	---	---	---	---	---
			690	57	3	6.9	18.8	46	71	7	1.8	111	.754	1.479	.197	.029	2.220
			920	57	3	6.9	18.4	---	---	---	---	---	---	---	---	---	---
			1220	57	4	6.9	18.1	42	71	5	1.7	90	.689	1.480	.141	.021	1.800
		West	300	57	2	6.9	18.4	---	---	---	---	---	---	---	---	---	---
			600	57	2	6.9	18.5	40	56	4	1.8	78	.787	1.166	.113	.021	1.560
			900	57	3	7.0	24.0	---	---	---	---	---	---	---	---	---	---
			1130	57	3	7.3	25.7	68	77	6	1.4	96	1.114	1.604	.169	.023	1.920
			1300	58	3	7.3	29.3	100	62	8	2.1	120	1.639	1.292	.225	.034	2.400

Susquehanna River at Harrisburg--Continued

Cross-section samples for water year ended September 30, 1946--Continued

Date	Discharge (second-feet)	Sampling point: Channel	Sampling point: Station	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Parts per million: Sulfate (SO_4)	Parts per million: Chloride (Cl)	Parts per million: Nitrate (NO_3)	Parts per million: Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Equivalents per million: Sulfate (SO_4)	Equivalents per million: Chloride (Cl)	Equivalents per million: Nitrate (NO_3)	Equivalents per million: Total hardness as $CaCO_3$
May 15	23,300	East	140	58	2	6.3	27.9	14	93	6	1.9	96	0.229	1.936	0.169	0.031	1.920
			300	59	2	6.4	27.7	---	---	---	---	---	---	---	---	---	---
			500	59	2	6.7	25.4	---	---	---	---	---	---	---	---	---	---
			690	59	2	6.8	23.0	40	56	7	1.6	84	.656	1.166	.197	.026	1.680
			920	58	2	6.7	18.6	---	---	---	---	---	---	---	---	---	---
			1220	59	2	6.3	16.4	12	47	4	1.1	60	.197	.979	.113	.018	1.200
		West	300	58	2	6.3	14.0	---	---	---	---	---	---	---	---	---	---
			600	58	3	6.4	15.2	20	44	3	1.4	54	.328	.916	.085	.023	1.080
			900	59	3	6.7	17.4	---	---	---	---	---	---	---	---	---	---
			1100	59	7	7.1	23.0	70	35	4	2.5	90	1.147	.729	.113	.040	1.800
			1300	59	4	7.4	31.1	131	21	4	6.1	114	2.147	.437	.113	.098	2.280
May 24	96,600	East	140	60	4	5.9	13.6	6	51	3	2.2	57	.098	1.062	.085	.035	1.140
			300	61	4	5.8	13.1	---	---	---	---	---	---	---	---	---	---
			500	61	8	6.2	11.1	---	---	---	---	---	---	---	---	---	---
			690	61	13	6.4	10.3	17	28	1	2.2	45	.279	.583	.028	.035	.900
			920	61	12	6.4	9.68	---	---	---	---	---	---	---	---	---	---
			1220	61	14	6.4	8.37	19	25	2	2.1	42	.311	.521	.056	.034	.840
		West	300	61	12	6.5	7.89	---	---	---	---	---	---	---	---	---	---
			600	61	12	6.4	7.76	16	23	2	2.1	36	.262	.479	.056	.034	.720
			900	61	13	6.6	8.47	---	---	---	---	---	---	---	---	---	---
			1100	62	14	6.8	8.93	26	23	4	1.9	50	.426	.479	.113	.031	1.000
			1300	62	17	6.9	10.8	34	23	2	2.1	52	.557	.479	.056	.034	1.040
June 13	55,100	East	140	69	3	5.9	26.8	5	123	3	1.7	120	.082	2.561	.085	.027	2.400
			300	69	3	6.3	24.4	---	---	---	---	---	---	---	---	---	---
			500	70	4	6.9	20.6	---	---	---	---	---	---	---	---	---	---
			690	69	9	7.2	18.5	33	51	2	1.9	75	.541	1.062	.056	.031	1.500
			920	69	14	7.1	17.3	---	---	---	---	---	---	---	---	---	---
			1220	69	18	7.0	14.3	22	39	2	2.0	54	.361	.812	.056	.032	1.080
		West	300	69	17	6.9	12.8	---	---	---	---	---	---	---	---	---	---
			600	70	16	7.0	12.1	28	30	3	1.7	51	.459	.625	.085	.027	1.020
			900	70	17	7.4	14.6	---	---	---	---	---	---	---	---	---	---
			1100	70	18	7.5	15.9	60	24	3	2.9	60	.983	.500	.085	.047	1.200
			1300	70	26	7.5	25.1	112	18	2	6.2	96	1.836	.375	.056	.100	1.920
June 26	30,500	East	140	75	7	6.2	31.4	12	125	2	2.3	135	.197	2.603	.056	.037	2.700
			300	75	8	6.5	28.7	---	---	---	---	---	---	---	---	---	---
			500	75	8	6.6	23.0	---	---	---	---	---	---	---	---	---	---
			690	74	9	6.6	17.5	24	53	2	1.8	63	.393	1.103	.056	.029	1.260
			920	73	6	6.1	14.0	---	---	---	---	---	---	---	---	---	---
			1220	72	7	5.2	13.9	2	50	3	1.4	42	.033	1.041	.085	.023	.840
		West	300	73	4	5.9	12.6	---	---	---	---	---	---	---	---	---	---
			600	73	4	6.5	14.2	24	41	2	2.1	56	.393	.854	.056	.034	1.120
			900	73	6	7.0	16.7	---	---	---	---	---	---	---	---	---	---
			1100	71	10	7.2	16.8	58	31	2	2.9	68	.951	.645	.056	.047	1.360
			1300	72	9	7.5	26.6	130	25	2	6.7	122	2.131	.521	.056	.108	2.440
July 15	12,500	East	140	76	2	5.4	41.4	3	192	4	1.9	174	.049	3.997	.113	.031	3.480
			300	77	3	6.2	38.6	---	---	---	---	---	---	---	---	---	---
			500	76	3	6.6	32.6	---	---	---	---	---	---	---	---	---	---
			690	76	2	6.9	26.3	36	87	1	1.3	108	.590	1.811	.028	.021	2.160
			920	75	3	6.8	26.0	---	---	---	---	---	---	---	---	---	---
			1220	75	2	6.6	18.4	22	60	3	1.6	69	.361	1.249	.085	.026	1.380
		West	300	75	3	6.7	17.5	---	---	---	---	---	---	---	---	---	---
			600	75	2	6.9	18.1	36	48	1	2.6	78	.590	.999	.028	.042	1.560
			900	75	5	7.1	23.8	---	---	---	---	---	---	---	---	---	---
			1100	76	5	7.2	25.4	95	39	5	3.6	120	1.557	.812	.141	.058	2.400
			1300	75	5	7.6	33.9	175	22	4	14	174	2.868	.458	.113	.226	3.480

Susquehanna River at Harrisburg--Continued

Cross-section samples for water year ended September 30, 1946--Continued

Date	Discharge (second-feet)	Sampling point: Channel	Sampling point: Station	Temperature (°F.)	Color	pH	Specific conductance (K x 10⁶ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Parts per million: Sulfate (SO_4)	Parts per million: Chloride (Cl)	Parts per million: Nitrate (NO_3)	Parts per million: Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Equivalents per million: Sulfate (SO_4)	Equivalents per million: Chloride (Cl)	Equivalents per million: Nitrate (NO_3)	Equivalents per million: Total hardness as $CaCO_3$
July 26	21,100	East	140	74	1	5.1	38.0	2	103	5	2.2	168	0.033	3.394	0.141	0.035	3.360
			300	75	1	5.8	38.9	---	---	---	---	---	---	---	---	---	---
			500	75	1	6.5	37.9	---	---	---	---	---	---	---	---	---	---
			690	75	1	6.8	35.8	34	130	5	1.8	150	.557	2.707	.141	.029	3.000
			920	75	2	6.8	30.9	---	---	---	---	---	---	---	---	---	---
			1220	74	2	6.7	24.2	25	80	5	2.1	76	.410	1.666	.141	.034	1.520
		West	300	74	2	6.7	22.6	---	---	---	---	---	---	---	---	---	---
			600	75	3	7.0	21.2	35	63	5	2.2	72	.574	1.312	.141	.035	1.440
			900	75	3	7.1	22.6	---	---	---	---	---	---	---	---	---	---
			1100	74	5	7.2	24.8	94	37	5	3.8	102	1.541	.770	.141	.061	2.040
			1300	72	5	7.5	32.1	153	26	5	6.2	150	2.507	.541	.141	.100	3.000
Aug. 5	22,400	East	140	75	2	4.5	37.8	[a]0	161	4	1.6	130	.000	3.352	.113	.026	2.600
			300	75	2	4.5	36.8	---	---	---	---	---	---	---	---	---	---
			500	75	2	5.2	29.6	---	---	---	---	---	---	---	---	---	---
			690	75	1	5.9	26.7	6	106	6	2.0	100	.098	2.207	.169	.032	2.000
			920	75	3	6.1	24.6	---	---	---	---	---	---	---	---	---	---
			1220	75	2	6.4	21.5	14	74	5	2.0	76	.229	1.541	.141	.032	1.520
		West	300	75	3	6.5	20.7	---	---	---	---	---	---	---	---	---	---
			600	75	4	6.5	19.9	20	67	4	2.4	80	.328	1.395	.113	.039	1.600
			900	75	4	6.8	20.9	---	---	---	---	---	---	---	---	---	---
			1100	74	6	7.0	23.6	82	37	6	3.3	87	1.344	.770	.169	.053	1.740
			1300	75	4	7.3	31.1	146	28	4	8.3	128	2.393	.582	.113	.134	2.560
Aug. 15	12,200	East	140	71	1	5.6	36.7	4	161	4	3.0	144	.066	3.352	.113	.048	2.880
			300	72	0	5.9	34.5	---	---	---	---	---	---	---	---	---	---
			500	72	1	6.3	28.9	---	---	---	---	---	---	---	---	---	---
			690	71	2	6.5	24.9	27	78	4	2.4	93	.442	1.624	.113	.039	1.860
			1220	70	0	6.4	19.0	19	63	3	1.8	70	.311	1.312	.085	.029	1.400
		West	300	71	0	6.5	18.0	---	---	---	---	---	---	---	---	---	---
			600	71	0	6.5	17.2	24	51	3	1.7	69	.393	1.062	.085	.027	1.380
			900	71	2	6.7	17.6	---	---	---	---	---	---	---	---	---	---
			1100	72	1	7.2	21.2	62	47	3	2.1	87	1.016	.979	.085	.034	1.740
			1300	70	1	7.5	28.3	131	27	5	8.0	122	2.147	.562	.141	.129	2.440
Sept. 4	5,800	East	140	63	1	4.7	53.6	[a]0	247	6	2.2	225	.000	5.143	.169	.035	4.500
			300	64	0	4.8	52.4	---	---	---	---	---	---	---	---	---	---
			500	63	0	5.9	45.0	---	---	---	---	---	---	---	---	---	---
			690	64	0	6.6	36.0	21	143	6	2.0	141	.344	2.977	.169	.032	2.820
			920	64	1	6.6	28.1	---	---	---	---	---	---	---	---	---	---
			1220	65	0	6.7	23.5	29	73	6	1.7	93	.475	1.520	.169	.027	1.860
		West	300	65	1	6.8	23.4	---	---	---	---	---	---	---	---	---	---
			600	65	1	6.9	24.9	56	65	6	2.0	99	.918	1.353	.169	.032	1.980
			900	65	2	7.2	31.5	---	---	---	---	---	---	---	---	---	---
			1100	64	2	7.3	32.2	106	61	6	1.6	126	1.737	1.270	.169	.026	2.520
			1300	63	4	7.2	29.2	144	18	4	9.8	120	2.360	.375	.113	.155	2.580
Sept. 12	5,340	East	140	69	2	4.7	42.4	[a]0	189	6	2.3	176	.000	3.935	.169	.037	3.520
			300	69	3	4.7	47.1	---	---	---	---	---	---	---	---	---	---
			500	69	4	5.0	47.5	---	---	---	---	---	---	---	---	---	---
			690	69	5	7.1	41.4	13	174	3	3.0	171	.213	3.623	.085	.048	3.420
			920	69	4	6.7	33.8	---	---	---	---	---	---	---	---	---	---
			1220	67	2	6.8	27.9	40	86	5	2.0	124	.656	1.791	.141	.032	2.440
		West	300	70	2	7.2	26.0	---	---	---	---	---	---	---	---	---	---
			600	68	3	7.0	27.7	72	60	8	1.6	114	1.180	1.249	.226	.026	2.280
			900	69	4	7.2	28.7	---	---	---	---	---	---	---	---	---	---
			1100	69	3	7.4	32.7	143	31	6	6.4	135	2.344	.646	.169	.103	2.700
			1300	68	4	7.5	34.8	178	19	4	11	156	2.917	.396	.113	.177	3.120

[a]Free acid as H_2SO_4 - 0.

Susquehanna River at Harrisburg--Continued

Cross-section samples for water year ended September 30, 1946--Continued

Date	Discharge (second-feet)	Sampling point Channel	Station	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$	Equivalents per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$
Sept. 25	8,540	East	140	68	3	4.8	50.6	[a]0	237	8	1.6	202	0.000	4.934	0.226	0.026	4.040
			300	68	2	4.8	53.6	---	---	---	---	---	---	---	---	---	---
			500	68	2	6.1	48.2	---	---	---	---	---	---	---	---	---	---
			690	69	2	6.9	39.7	25	154	8	2.7	174	.410	3.206	.226	.044	3.480
			920	69	3	6.7	33.7	---	---	---	---	---	---	---	---	---	---
			1220	69	4	6.9	28.9	46	90	8	2.2	114	.754	1.874	.226	.035	2.280
		West	300	69	4	7.2	28.4	---	---	---	---	---	---	---	---	---	---
			600	69	3	7.2	28.2	84	61	6	2.6	105	1.377	1.270	.169	.042	2.100
			900	69	5	7.1	24.9	---	---	---	---	---	---	---	---	---	---
			1100	67	5	7.1	22.5	102	19	2	8.4	100	1.672	.396	.056	.135	2.000
			1300	68	7	7.2	24.1	110	19	1	8.0	105	1.803	.396	.028	.129	2.100

[a] Free acid as H_2SO_4 = 0.

Cross-section samples of Ohio River at Sewickley and at Ambridge, Pa., 1945 and 1946

Ohio River at Sewickley

Date	Discharge (second-feet)	Station	Time	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$	Total acidity as H_2SO_4	Equivalents per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$
Sept. 20, 1945	64,800	1150	1:20 pm	65	---	4.4	22.2	0	86	5	1.9	79	10	0.000	1.791	0.141	0.031	1.560
		850	1:15	65	---	4.3	23.0	0	89	6	2.0	87	12	.000	1.853	.169	.032	1.740
		600	1:05	65	---	4.1	29.4	0	105	9	2.0	90	16	.000	2.186	.254	.032	1.800
		370	12:55	66	---	4.0	34.9	0	125	14	2.1	117	14	.000	2.603	.395	.034	2.340
		140	12:45	66	---	4.1	36.7	0	135	20	1.9	129	16	.000	2.811	.564	.031	2.580
Oct. 24-- ---	17,400	1100	1:15	54	---	5.8	35.0	11	128	14	.8	120	---	.180	2.665	.395	.013	2,520
		840	1:00	54	---	5.8	33.0	13	121	15	.8	120	---	.213	2.519	.423	.013	2.400
		600	12:50	54	---	5.6	32.7	11	121	14	1.0	114	---	.180	2.519	.395	.016	2.280
		380	12:40	54	---	5.7	32.4	11	119	14	1.0	114	---	.180	2.478	.395	.016	2.280
		140	12:30	54	---	5.3	31.6	6	119	12	3.0	120	---	.098	2.478	.367	.048	2.400
Nov. 16-- --	39,200	1150	2:55	49	3	4.8	36.5	4	165	9	3.4	114	---	.066	3.435	.226	.055	2.280
		850	2:30	---	4	5.0	36.6	5	151	8	3.3	108	---	.082	3.144	.226	.053	2.160
		600	1:30	49	8	5.4	29.7	4	118	10	2.0	93	---	.066	2.457	.282	.032	1.860
		370	12:55	49	5	5.7	23.1	6	82	11	1.0	69	---	.098	1.707	.310	.029	1.380
		140	12:35	48	5	6.0	20.6	12	77	10	1.0	69	---	.197	1.603	.282	.026	1.380
Dec. 18-------	13,500	1150	4:10	32	3	5.2	28.5	5	101	12	2.4	90	---	.082	2.103	.338	.036	1.800
		850	4:00	32	3	5.4	27.5	7	102	10	.8	86	---	.115	2.124	.282	.010	1.720
		600	3:50	32	4	5.4	26.9	5	101	11	1.1	87	---	.082	2.103	.310	.018	1.740
		370	3:30	33	3	5.7	24.2	6	86	10	1.0	78	---	.098	1.791	.282	.016	1.560
		140	3:45	32	3	5.7	22.8	4	85	9	1.1	78	---	.066	1.770	.254	.018	1.640
Jan. 15, 1946 --	62,700	1150	11:00 am	36	5	5.7	20.8	6	76	6	2.1	69	---	.098	1.582	.169	.034	1.380
		850	11:20	36	2	5.3	19.4	4	71	6	2.0	65	---	.066	1.478	.169	.032	1.260
		600	11:25	36	2	5.1	17.0	7	56	6	2.0	61	---	.147	1.166	.169	.032	1.020
		370	11:30	37	3	6.0	14.2	8	43	5	2.0	47	---	.133	.895	.226	.032	.960
		140	11:35	37	5	6.1	14.0	10	41	10	2.0	47	---	.164	.854	.282	.032	.900
Feb. 15	60,000	1150	11:55	33	5	5.3	26.7	1	90	4	1.5	84	---	.066	2.061	.113	.024	1.680
		850	11:50	33	5	5.2	25.3	4	87	6	1.4	81	---	.066	2.020	.169	.023	1.620
		600	11:45	32	5	5.5	25.1	4	88	10	3.0	78	---	.066	1.832	.282	.048	1.560
		370	11:45	32	4	6.0	26.3	12	78	14	2.6	81	---	.197	1.624	.395	.042	1.620
		140	11:35	32	5	6.3	26.7	16	77	16	2.6	75	---	.262	1.603	.508	.042	1.560
Mar. 15---	62,700	1150	10:25	48	3	5.7	34.9	4	98	7	1.2	84	---	.131	1.999	.169	.021	1.680
		850	10:30	48	4	5.5	27.8	5	75	5	1.0	72	---	.098	1.853	.226	.026	1.440
		600	10:40	47	3	5.7	24.-	4	60	4	1.0	62	---	.066	1.416	.226	.026	1.200
		370	10:50	45	3	6.1	21.-	1	47	3	.7	51	---	.164	1.020	.226	.014	1.020
		140	11:-	45	8	6.1	21.7	1	47	3	.7	50	---	.262	1.092	.282	.024	1.200
Apr. 15---	11,000	1150	1:-	57	3	5.-	4.-	4	.7	4	1.1	36	---	.033	2.-	.564	.015	2.160
		850	1:-	4	3	4.-	5.-	5	12.-	7	1.1	3.-	---	.-	2.727	.473	.01	2.120
		600	1:00	---	3	4.-	5.-	4	13.-	17	1.1	11.-	---	.-	2.-	.479	.019	2.220
		370	1:-	---	3	5.-	4.-	---	14.-	17	1.1	3.-	---	.-	2.727	.479	.016	2.040
		140	1:-	---	3	5.-	4.-	1	14.-	1	1.1	1.-	---	.-	2.767	.-	.019	2.120
May 1---	42,000	1150	2:-	62	3	5.-	.-	4	117	11	.8	117	---	.049	3.061	.508	.005	2.460
		850	2:10	61	3	5.-	.4	8	105	10	.4	10-	---	.098	2.686	.441	.006	2.400
		600	2:00	61	3	5.7	1.-	11	101	11	.8	1-	---	.180	2.113	.536	.008	2.220
		370	1:-	61	2	5.-	.-	7	92	11	2.4	111	---	.131	2.-	.-	.03-	2.220
		140	1:50	61	3	6.-	.4	10	100	20	1.2	12-	---	.-	2.843	.649	.024	2.280
June 17---	42,400	1150	2:10	67	2	5.-	.7	4	91	5	.9	7-	---	.049	1.888	.220	.016	1.500
		850	2:55	67	3	5.-	1.7	7	82	6	.8	6-	---	.049	1.728	.226	.015	1.380
		600	3:00	69	4	5.-	1.-	5	73	8	1.0	60	---	.082	1.520	.226	.016	1.200
		370	3:10	67	4	6.1	.-	4	68	8	1.-	5-	---	.-	1.416	.279	.015	1.200
		140	3:15	67	4	6.-	.-	4	69	8	.-	5-	---	.142	1.437	.226	.013	1.200

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Cross-section samples of Ohio River at Sewickley and at Ambridge, Pa., 1945 and 1946--Continued

Ohio River at Sewickley--Continued

Date	Discharge (second-feet)	Station	Time	Temperature (°F.)	Color	pH	Specific conductance (Kx10^6 at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$	Total acidity as H_2SO_4	Equivalents per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$
July 17	6,540	1150	2:50 pm	82	4	4.15	42.2	0	174	17	3.4	138	14	0.000	3.623	0.479	0.055	2.760
		850	2:55	81	6	4.15	41.8	0	165	16	3.1	120	14	.000	3.435	.451	.050	2.400
		600	3:00	80	5	5.0	39.6	1	160	15	3.5	114	8	.016	3.331	.423	.056	2.280
		370	3:10	80	4	5.1	39.5	1	158	15	.5	116	---	.016	3.290	.423	.008	2.320
		140	3:15	81	3	5.2	39.3	1	164	15	.5	116	---	.016	3.415	.423	.008	2.320
Aug. 13	5,820	1150	11:30 am	76	1	4.6	50.1	0	190	26	1.5	129	25	.000	3.956	.733	.024	2.580
		850	11:00	76	1	4.10	52.1	0	191	25	3.5	138	27	.000	3.977	.705	.056	2.760
		600	10:25	76	2	4.00	53.1	0	191	25	3.4	141	28	.000	3.977	.705	.055	2.820
		370	9:30	75	1	4.5	50.3	0	183	27	3.4	141	26	.000	3.810	.761	.055	2.820
		140	8:55	75	1	4.5	50.4	0	185	27	3.6	153	17	.000	3.852	.761	.058	3.060
Sept. 18	2,970	1150	10:05	74	5	3.80	77.2	0	280	39	7.2	204	27	.000	5.830	1.110	.116	4.080
		850	10:00	74	3	3.75	77.2	0	279	36	7.9	198	28	.000	5.809	1.015	.127	3.960
		600	9:55	75	4	3.75	76.6	0	280	36	7.2	204	28	.000	5.830	1.015	.116	4.080
		370	9:45	74	3	3.70	76.9	0	275	36	7.4	198	30	.000	5.726	1.015	.119	3.960
		140	9:40	74	2	3.75	76.5	0	277	35	6.6	210	29	.000	5.767	.987	.106	4.200
Ohio River at Ambridge																		
Sept. 20, 1945	64,800	1380	2:30 pm	65	---	4.4	24.4	0	90	7	2.0	93	10	.000	1.874	.197	.032	1.860
		1090	2:35	65	---	4.5	25.6	0	94	8	2.3	93	8	.000	1.957	.226	.037	1.860
		870	2:40	65	---	4.3	27.9	0	102	10	2.0	99	10	.000	2.124	.282	.032	1.980
		625	2:45	65	---	4.4	30.2	0	113	12	2.3	108	10	.000	2.353	.338	.037	2.160
		340	2:50	66	---	4.4	32.4	0	117	15	2.4	111	10	.000	2.436	.423	.039	2.220
Oct. 24	17,400	1380	2:30	54	---	5.7	33.3	7	126	14	2.7	126	---	.115	2.623	.395	.044	2.520
		1090	2:15	54	---	5.7	32.7	11	124	14	1.0	120	---	.180	2.582	.395	.016	2.400
		870	2:05	54	---	5.8	32.1	10	122	14	1.2	114	---	.164	2.540	.395	.019	2.280
		625	1:55	54	---	5.8	31.6	6	120	14	2.9	114	---	.098	2.498	.395	.047	2.280
		340	1:45	54	---	5.5	31.9	6	117	14	2.9	114	---	.098	2.436	.395	.047	2.280
Nov. 16	69,200	1380	2:35	50	3	4.9	36.1	3	144	9	3.4	114	---	.049	2.998	.254	.055	2.280
		1090	2:40	50	4	5.0	33.9	4	130	9	2.9	102	---	.066	2.717	.254	.047	2.040
		870	2:45	49	3	5.1	31.1	4	126	9	3.3	102	---	.066	2.623	.254	.053	2.040
		625	2:50	49	4	5.6	26.0	6	94	10	2.4	87	---	.098	1.957	.282	.387	1.740
		340	2:55	49	5	5.8	22.8	9	79	12	2.3	75	---	.147	1.645	.338	.037	1.500
Dec. 18	13,500	1380	3:20	32	3	5.9	25.4	6	89	12	1.5	78	---	.098	1.853	.338	.024	1.560
		1090	3:15	32	3	5.8	25.2	6	88	11	1.6	81	---	.098	1.832	.310	.026	1.620
		870	3:05	32	3	5.7	24.8	8	86	10	1.0	69	---	.131	1.791	.282	.016	1.380
		625	2:55	32	3	5.6	24.3	10	85	11	.9	81	---	.164	1.770	.310	.014	1.620
		340	2:50	32	2	5.8	24.7	11	85	11	1.0	78	---	.180	1.770	.310	.016	1.560
Jan. 15, 1946	62,700	1380	2:00	38	5	5.7	18.8	4	68	6	2.0	63	---	.066	1.416	.169	.032	1.260
		1090	1:55	38	3	5.6	18.4	4	67	4	1.9	60	---	.066	1.395	.113	.031	1.200
		870	1:50	37	2	5.8	16.5	4	59	8	2.2	60	---	.066	1.228	.226	.035	1.200
		625	1:45	37	5	5.9	15.3	8	47	8	1.8	54	---	.131	.979	.226	.029	1.080
		340	1:25	37	7	6.1	14.4	10	40	10	1.8	48	---	.164	.833	.282	.029	.960

Ohio River at Ambridge--Continued

Date	Discharge (second-feet)	Station	Time	Temperature (°F.)	Color	pH	Specific conductance (Kx10^5 at 25°C.)	Parts per million						Equivalents per million				
								Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$	Total acidity as H_2SO_4	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$
Feb. 18	45,400	1380	9:15am	36	5	6.6	23.9	20	74	8	3.1	84	---	0.328	1.541	0.226	0.050	1.680
		1090	9:10	35	4	5.9	21.5	12	74	10	2.6	72	---	.197	1.541	.282	.042	1.440
		870	9:05	35	4	5.9	20.7	10	60	10	2.6	66	---	.164	1.249	.282	.042	1.320
		625	9:00	34	5	6.1	20.6	14	55	12	2.4	69	---	.229	1.145	.338	.039	1.380
		340	8:55	34	5	6.3	21.5	20	51	18	2.5	66	---	.328	1.062	.508	.040	1.320
Mar. 15	62,700	1380	4:10pm	50	7	5.6	24.8	6	100	8	1.7	87	---	.098	2.082	.226	.027	1.740
		1090	4:15	48	8	5.8	23.8	6	87	8	1.9	78	---	.098	1.811	.226	.031	1.560
		870	4:20	48	8	5.9	21.4	8	81	6	1.9	69	---	.131	1.686	.169	.031	1.380
		625	4:25	47	8	5.9	18.1	8	63	8	1.9	63	---	.131	1.312	.226	.029	1.260
		340	4:30	46	7	6.2	16.3	12	53	8	1.4	54	---	.197	1.103	.226	.023	1.080
Apr. 16	12,500	1380	9:55am	52	4	5.3	35.2	8	134	17	1.0	105	---	.131	2.790	.479	.016	2.100
		1090	9:50	52	3	5.0	35.3	6	132	17	1.0	105	---	.098	2.748	.479	.016	2.100
		870	9:45	52	3	4.9	35.3	7	133	17	.9	106	---	.115	2.769	.479	.015	2.120
		625	9:40	51	4	5.2	35.4	8	135	18	.9	104	---	.131	2.811	.508	.015	2.080
		340	9:35	52	5	5.2	35.3	5	130	18	1.0	104	---	.082	2.707	.508	.016	2.080
May 15	43,400	1380	3:20pm	62	3	5.9	32.8	6	129	12	.5	90	---	.098	2.686	.338	.008	1.800
		1090	3:15	61	3	5.8	33.8	6	125	16	.4	102	---	.098	2.603	.451	.006	2.040
		870	3:10	61	3	5.9	33.1	8	114	20	.4	87	---	.131	2.374	.564	.006	1.740
		625	3:05	61	3	5.7	31.9	6	104	20	2.0	90	---	.098	2.165	.564	.032	1.800
		340	2:55	61	3	6.0	31.1	14	105	22	1.7	108	---	.229	2.186	.620	.027	2.160
June 17	45,400	1380	1:10	70	2	5.3	24.2	3	87	8	.8	72	---	.049	1.811	.226	.013	1.440
		1090	1:15	69	3	5.5	24.0	4	81	8	.7	72	---	.066	1.686	.226	.011	1.440
		870	1:22	69	2	5.5	20.1	5	80	9	1.0	75	---	.082	1.666	.254	.016	1.500
		625	1:28	69	4	5.9	19.5	8	72	8	1.0	69	---	.131	1.499	.226	.016	1.380
		340	1:35	69	5	6.0	19.2	12	67	8	.7	66	---	.197	1.395	.226	.011	1.320
July 17	6,540	1380	4:25	81	2	4.40	41.6	0	168	16	2.9	129	15	.000	3.498	.451	.047	2.580
		1090	4:20	81	1	4.5	41.1	0	170	15	2.3	138	13	.000	3.539	.423	.037	2.760
		870	4:15	80	1	4.25	42.3	0	163	15	3.2	138	14	.000	3.394	.423	.052	2.760
		625	4:10	81	1	4.9	40.5	0	162	15	2.9	123	11	.000	3.373	.423	.047	2.460
		340	4:00	81	1	4.20	42.5	0	162	16	3.4	135	18	.000	3.373	.451	.055	2.700
Aug. 13	5,820	1380	1:45	76	3	4.20	50.6	0	184	27	2.9	110	18	.000	3.831	.761	.047	2.200
		1090	1:40	76	1	4.15	50.9	0	179	26	3.8	114	20	.000	3.727	.733	.061	2.280
		870	1:35	76	4	4.15	51.0	0	195	27	3.4	114	19	.000	4.060	.761	.055	2.280
		625	1:30	76	3	4.20	50.9	0	200	26	3.4	126	18	.000	4.164	.733	.055	2.520
		340	1:25	76	2	4.30	50.7	0	181	27	3.9	144	18	.000	3.768	.761	.063	2.880
Sept. 19	2,640	1380	9:10am	73	2	3.75	75.5	0	274	36	6.2	195	31	.000	5.705	1.015	.100	3.900
		1090	9:15	73	3	3.80	75.6	0	273	36	6.8	210	26	.000	5.684	1.015	.110	4.200
		870	9:20	73	4	3.75	76.4	0	272	36	7.2	201	28	.000	5.663	1.015	.116	4.020
		625	9:25	73	4	3.70	77.0	0	274	36	6.0	198	30	.000	5.705	1.015	.097	3.960
		340	9:30	73	5	3.75	77.4	0	272	36	7.4	201	30	.000	5.663	1.015	.119	4.020

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ROCEDURES

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West Branch Susquehanna River Basin

Analyses of water samples collected during periods of low flow in 1944 and 1945

Source	Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
											Parts per million											
West Branch Susquehanna River at Barnesboro	Sept. 10, 1945	12.1	76	15	2.70	270	31	31	121	6.0	176	58	102	0	1,460	5.0	---	1.0	—	1,170	1,170	632
at McGhee's Mill	Sept. 11		72	2	3.40	110	9.8	6.2	1.0	1.7	19	33	47	0	244	4.5	---	.9	760	471	471	82
at Lower	Do.		73	2	3.55	82.2	6.0	3.7	.2	.5	4[illegible]	[illegible]	12	0	2[illegible]	9.0	---	1.0	353	220	220	45
near Coudley	Sept. 10		75	2	3.50	46.4	6.0	3.20	.20	1.4	32	11	5.0	0	170	3.2	--	1.0	244	165	165	46
near Coudley	Sept. 11		74	---	4.30	45.1	--	---	---	---	---	---	---	---	164	---	---	---	---	---	---	25
											Equivalents per million											
West Branch Susquehanna River at Barnesboro	Sept. 10, 1945		---	---	---	---	---	3.44[illegible]	3.[illegible]	.01	.782	4.770	7.026	0.000	30.[illegible]	0.141	---	0.01[illegible]	---	---	---	---
at McGhee's Mill	Sept. 11		--	---	---	---	---	.7[illegible]	.0[illegible]	.0[illegible]	.[illegible]	2.714	3.0[illegible]	.000	11.[illegible]	.127	---	.01[illegible]	---	---	---	---
at Bower	do.		---	---	---	---	---	.[illegible]12	.004	.0[illegible]	2.[illegible]	1.31[illegible]	.[illegible]32	.000	4.747	.103	--	.01[illegible]	---	---	---	---
near Coudley	Sept. 10		---	---	---	---	---	.[illegible]	.011	.01	1.[illegible]7	.[illegible]	.[illegible]5	.000	3.[illegible]	.090	---	.010	---	---	---	---
near Coudley	Sept. 11		---	--	---	---	---	---	--	--	--	--	---	---	3.41	---	---	---	---	---	---	---
											Parts per million											
West Branch Susquehanna River at Karthaus	Sept. 10		76	---	3.2[illegible]	70.2	---	---	---	---	---	---	---	---	2[illegible]	---	---	---	---	---	---	82
at Karthaus	Sept. 11		75	5	3.2[illegible]	64.7	---	--	--	--	---	---	---	---	[illegible]	4.0	---	---	---	--	---	68
at Renovo	Sept. 12		72	--	3.30	58.7	---	---	---	---	--	---	---	---	1[illegible]	--	--	---	---	---	---	60
at Lock Haven	Sept. 10		77	2	3.40	43.0	6.0	3.7	0.40	1.2	20	10	---	0	142	8.0	---	1.2	215	161	161	49
at Lock Haven	Sept. 13		71	---	3.20	50.0	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
											Equivalents per million											
West Branch Susquehanna River at Karthaus	Sept. 10		---	---	---	---	--	---	---	---	--	--	---	---	.[illegible]8	---	---	---	---	---	---	---
at Karthaus	Sept. 11		---	---	---	---	--	--	--	---	--	---	---	---	4.[illegible]	0.113	---	---	---	---	---	---
at Renovo	Sept. 12		---	---	---	---	--	---	---	---	---	---	---	---	4.[illegible]	--	---	---	---	---	---	---
at Lock Haven	Sept. 10		---	---	---	---	---	0.[illegible]2	0.[illegible]1	0.044	1.4[illegible]	0.[illegible]22	---	0.000	2.977	.226	---	0.019	---	---	---	---
at Lock Haven	Sept. 13		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
											Parts per million											
West Branch Susquehanna River at Williamsport	Sept. 13		75	5	[illegible]	28.3	---	---	---	---	---	---	---	32	89	10	---	1.6	---	108	82	---
at Lewisburg	Sept. 11-20		68	8	[illegible].7	21.6	3.4	---	0.[illegible]2	0.1	20	[illegible].[illegible]	8.2	22	62	[illegible].2	0.1	1.9	132	82	64	---
Chest Creek at Patton	Sept. 11		67	---	[illegible].5	20.7	---	---	---	---	--	---	---	40	51	2.0	---	2.[illegible]	---	90	50	---
Chest Creek at Mahaffey	do.		70	12	[illegible].8	30.2	5.4	--	.0[illegible]	---	3[illegible]	10	8.[illegible]	25	101	10	.1	1.3	192	128	108	---
Anderson Creek at Curwensville	do.		72	4	3.85	17.0	4.6	2.1	.24	.[illegible]	[illegible].[illegible]	3.1	---	0	53	1.0	---	.6	84	56	56	25
											Equivalents per million											
West Branch Susquehanna River at Williamsport	Sept. 13		---	---	---	---	---	---	---	---	---	---	---	0.[illegible]4	1.[illegible]3	0.252	---	0.026	---	---	---	---
at Lewisburg	Sept. 11-20		---	---	---	---	---	---	---	---	1.00[illegible]	.[illegible]34	0.[illegible]6	.311	1.[illegible]1[illegible]	.[illegible]79	0.005	.021	---	---	---	---
Chest Creek at Patton	Sept. 11		---	---	---	---	---	---	---	---	---	---	---	.[illegible]33	1.0[illegible]	.0[illegible]	---	.042	---	---	---	---
Chest Creek at Mahaffey	do.		---	---	---	---	---	---	---	---	1.747	.[illegible]22	.[illegible]82	.410	2.10[illegible]	.[illegible]82	.005	.021	---	---	---	---
Anderson Creek at Curwensville	do.		---	---	---	---	---	0.[illegible]34	0.013	0.029	.42[illegible]	.[illegible]05	---	.000	1.103	.028	---	.010	---	---	---	---
											Parts per million											
Clearfield Creek at Ashville	Sept. 10		68	4	3.35	76.5	18	8.7	3.8	1.2	62	23	13	0	334	2.8	---	1.4	490	325	325	88
Clearfield Creek at Faunce	Sept. 11		74	3	3.35	52.8	10	4.2	.35	1.4	33	14	---	0	191	3.0	—	1.2	284	204	204	58
Clearfield Creek near Clearfield	do.		75	2	3.50	36.3	0.4	2.3	.44	1.0	24	[illegible].6	1.9	0	123	1.8	—	1.2	163	127	127	40
Little Clearfield Creek near Glen Richey	do.		73	5	[illegible].6	13.4	---	---	---	---	---	---	---	27	35	1.0	---	.9	---	57	35	---
Little Clearfield Creek at Dimeling	do.		72	25	[illegible].1	12.0	4.7	---	.13	---	14	4.0	---	22	31	1.4	0.1	1.1	7[illegible]	51	33	---
											Equivalents per million											
Clearfield Creek at Ashville	Sept. 10		---	---	---	---	---	0.[illegible]65	0.[illegible]0	0.044	3.0[illegible]	1.[illegible]91	0.561	0.000	6.[illegible]84	0.079	---	0.023	---	---	---	---
Clearfield Creek at Faunce	Sept. 11		---	---	---	---	---	.407	.01[illegible]	.051	1.6[illegible]	1.151	---	.000	3.977	.055	—	.019	---	---	---	---
Clearfield Creek near Clearfield	do.		---	---	---	---	---	.2[illegible]	.02[illegible]	.03[illegible]	1.1[illegible]	.707	.084	.000	2.561	.051	---	.019	---	---	---	---
Little Clearfield Creek near Glen Richey	do.		---	--	---	---	--	--	---	---	--	--	--	.442	.[illegible]12	.028	---	.015	---	---	---	---
Little Clearfield Creek at Dimeling	do.		---	---	---	---	--	---	--	---	.[illegible]3	.32[illegible]	---	.361	.[illegible]46	.040	0.00[illegible]	.01[illegible]	---	---	---	---

Source	Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (micro-mhos at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as CaCO3: Total	Hardness as CaCO3: Noncarbonate	Total acidity as H_2SO_4
Mosquito Creek at Kerthaus	Sept. 12, 1944	4.5	60	10	4.10	121	12	13	2.4	0.4	4.1	21	0.2	0	2.8	2.2	0.2	0.1	636	309	399	227
Driftwood Branch Sinemahoning Creek at Emporium	---do---	10.8	70	35	4.30	114	4.0	---	.03	---	20	2.0	1.4	0	2.5	---	---	---	---	---	---	262
Driftwood Branch Sinemahoning Creek at Sterling Run	---do---		69	17	4.7	114	2.0	---	.01	---	10	2.3	.91	0	3.0	6.0	0.1	1.2	573	368	388	226
Driftwood Branch Sinemahoning Creek at Driftwood	---do---	90.1	73	8	4.1	118	1.4	10	2.3	.10	4.1	1.6	1.4	0	4.0	4.0	1.3	1.3	577	382	382	220
Sinnemahoning Creek at Sinnemahoning	---do---	11.1	71	3.70		3.0	10	7.1	.33	1.2	2.6	1.5	.7	0	111	8.0	.1	.3	223	159	64	64

West Branch Susquehanna River Basin.- Continued

Source	Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (K x 10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Total acidity as H_2SO_4
														Parts per million								
Kettle Creek at Cross Fork	Sept. 12, 1945		70	4	6.0	5.24	---	---	---	---	---	---	---	24	---	1	---	0.2	---	---	---	---
Kettle Creek near Cross Fork	Aug. 11, 1944	7.82	73	10	6.4	6.70	3.1	---	0.01	---	7.8	1.8	1.7	20	7.4	1.6	0.0	.2	32	24	7	---
Do.	Sept. 12, 1945		71	5	6.6	5.24	---	---	---	---	---	---	---	24	7	1	---	.4	---	---	---	---
Kettle Creek at Westport	do.		73	5	6.5	7.46	---	---	---	---	---	---	---	10	---	---	---	---	---	---	---	---
Cross Fork near Cross Fork	do.		57	9	6.7	5.09	---	---	---	---	---	---	---	21	5	1	---	.1	---	22	5	---
														Equivalents per million								
Kettle Creek at Cross Fork	Sept. 12		---	---	---	---	---	---	---	---	---	---	---	.328	---	0.028	---	0.003	---	---	---	---
Kettle Creek near Cross Fork	Aug. 11, 1944	7.82	---	---	---	---	---	---	---	---	0.324	0.148	0.074	.328	0.164	.051	0.000	.003	---	---	---	---
Do.	Sept. 12, 1945		---	---	---	---	---	---	---	---	---	---	---	.328	---	.146	---	.006	---	---	---	---
Kettle Creek at Westport	do.		---	---	---	---	---	---	---	---	---	---	---	.164	---	---	---	---	---	---	---	---
Cross Fork near Cross Fork	do.		---	---	---	---	---	---	---	---	---	---	---	.344	.104	.028	---	.002	---	---	---	---
														Parts per million								
Hammersley Fork at Hammersley Fork	Sept. 12		69	---	---	5.23	---	---	---	---	---	---	---	20	---	---	---	---	---	---	---	---
Young Womans Creek near Renovo	Sept. 13	6.2	61	15	6.4	11.3	5.	---	0.01	---	15	1.3	2[illegible]	34	17	34	0.1	3.2	119	43	15	---
Bakers Run near Glen Union	Sept. 12		62	5	6.1	2.62	---	---	---	---	---	---	---	10	3	1	---	.1	---	14	5	---
North Bald Eagle Creek at Port Matilda	Sept. 11	6.5	73	14	7.1	11.2	6.6	---	.02	---	17	4.9	2.9	52	21	2.5	.1	.8	86	63	20	---
North Bald Eagle Creek above Beech Creek	Sept. 13		59	5	7.3	31.8	---	---	---	---	---	---	---	175	14	5	---	5.5	---	169	24	---
														Equivalents per million								
Hammersley Fork at Hammersley Fork	Sept. 12		---	---	---	---	---	---	---	---	---	---	---	.328	---	---	---	---	---	---	---	---
Young Womans Creek near Renovo	Sept. 13		---	---	---	---	---	---	---	---	0.748	0.107	1.103	.557	0.354	0.959	0.005	0.084	---	---	---	---
Bakers Run near Glen Union	Sept. 12		---	---	---	---	---	---	---	---	---	---	---	.164	.062	.028	---	.002	---	---	---	---
North Bald Eagle Creek at Port Matilda	Sept. 11		---	---	---	---	---	---	---	---	.848	.403	.126	.852	.437	.070	.005	.013	---	---	---	---
North Bald Eagle Creek above Beech Creek	Sept. 13		---	---	---	---	---	---	---	---	---	---	---	2.884	.291	.141	---	.080	---	---	---	---
														Parts per million								
North Bald Eagle Creek at Beech Creek Station	Aug. 12, 1944	167	70	9	7.8	32.8	2.7	---	0.02	---	40	16	2.0	176	14	5.0	0.0	5.0	188	166	21	---
Spring Creek near Axemann	Aug. 10	54.3	69	5	8.4	33.9	3.3	---	.02	---	44	18	1.0	[a]197	12	3.2	.0	9.4	198	184	22	---
Beech Creek at Beech Creek	Sept. 13, 1945	23.6	66	7	5.0	12.0	5.0	---	.01	---	12	4.1	1.8	2	44	2.2	.0	.2	80	47	45	---
Fishing Creek at Mill Hall	do.		58	4	7.4	27.1	---	---	---	---	---	---	---	153	14	2.0	---	5.2	---	138	13	---
Pine Creek at Ansonia	July 13		---	10	7.9	8.04	---	---	---	---	---	---	---	27	7	6.5	---	.1	---	34	12	---
														Equivalents per million								
North Bald Eagle Creek at Beech Creek Station	Aug. 12, 1944	167	---	---	---	---	---	---	---	---	1.997	1.316	0.086	2.885	0.291	0.141	0.000	0.081	---	---	---	---
Spring Creek near Axemann	Aug. 10	54.3	---	---	---	---	---	---	---	---	2.196	1.480	.015	3.229	.250	.040	.000	.152	---	---	---	---
Beech Creek at Beech Creek	Sept. 13, 1945	23.6	---	---	---	---	---	---	---	---	.599	.337	.078	.033	.916	.062	.000	.003	---	---	---	---
Fishing Creek at Mill Hall	do.		---	---	---	---	---	---	---	---	---	---	---	2.507	.291	.056	---	.084	---	---	---	---
Pine Creek at Ansonia	July 13		---	---	---	---	---	---	---	---	---	---	---	.442	.146	.183	---	.002	---	---	---	---
														Parts per million								
Pine Creek at Cedar Run	Aug. 30, 1944	13.1	80	4	7.2	13.6	2.4	---	0.02	---	14	3.3	6.1	25	26	7.5	1.2	0.6	75	48	28	---
Pine Creek at Waterville	July 14, 1945		73	8	7.2	8.68	---	---	---	---	---	---	---	23	15	4.5	---	.1	---	33	14	---
Pine Creek at Avis	do.		72	6	7.1	7.28	---	---	---	---	---	---	---	21	11	2.0	---	.4	---	30	13	---
Marsh Creek at Ansonia	July 13		80	13	7.1	15.9	---	---	---	---	---	---	---	44	12	8.5	---	1.8	---	56	20	---
Little Pine Creek at Waterville	July 14		71	3	7.2	4.55	---	---	---	---	---	---	---	14	5	.5	---	.1	---	---	---	---
														Equivalents per million								
Pine Creek at Cedar Run	Aug. 30, 1944		---	---	---	---	---	---	---	---	0.699	0.271	0.266	0.410	0.541	0.212	0.063	0.010	---	---	---	---
Pine Creek at Waterville	July 14, 1945		---	---	---	---	---	---	---	---	---	---	---	.377	.312	.127	---	.002	---	---	---	---
Pine Creek at Avis	do.		---	---	---	---	---	---	---	---	---	---	---	.344	.229	.056	---	.006	---	---	---	---
Marsh Creek at Ansonia	July 13		---	---	---	---	---	---	---	---	---	---	---	.721	.250	.240	---	.029	---	---	---	---
Little Pine Creek at Waterville	July 14		---	---	---	---	---	---	---	---	---	---	---	.229	.104	.014	---	.002	---	---	---	---

[a] Includes equivalent of 10 parts per million of carbonate (CO_3).

Source	Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (K x 10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as CaCO₃ Total	Hardness as CaCO₃ Non-carbonate	Total acidity as H_2SO_4
										Parts per million												
Little Pine Creek at Waterville	Sept. 13, 1945	14.0	75	3	6.3	4.01	3.1	---	0.01	---	0.2	1.2	2.1	19	7.4	1.5	0.1	0.3	28	20	6	---
Blockhouse Creek near English Center	Aug. 30, 1944	2.91	55	5	7.3	6.68	3.3	---	.02	---	0.6	1.3	2.0	24	8.4	2.0	.1	.1	37	26	6	---
Lycoming Creek near Trout Run	July 20	38.3	63	3	6.9	5.49	3.4	---	---	---	7.3	1.7	1.4	15	14	1.5	.1	.7	40	26	13	---
Lycoming Creek at Williamsport	Sept. 13, 1945		71	5	6.6	7.17	---	---	---	---	---	---	---	22	10	2.0	---	1.5	---	33	15	---
Loyalsock Creek at Montoursville	do.		72	5	6.6	5.17	---	---	---	---	---	---	---	19	8	1.0	---	.6	---	---	---	---
										Equivalents per million												
Little Pine Creek at Waterville	Sept. 13, 1945	14.0	---	---	---	---	---	---	---	---	0.300	0.099	0.091	0.305	0.154	0.042	0.005	0.005	---	---	---	---
Blockhouse Creek near English Center	Aug. 30, 1944	2.91	---	---	---	---	---	---	---	---	.400	.107	.104	.393	.185	.056	.005	.003	---	---	---	---
Lycoming Creek near Trout Run	July 20	38.3	---	---	---	---	---	---	---	---	.374	.148	.082	.246	.292	.012	.005	.011	---	---	---	---
Lycoming Creek at Williamsport	Sept. 13, 1945		---	---	---	---	---	---	---	---	---	---	---	.361	.209	.056	---	.024	---	---	---	---
Loyalsock Creek at Montoursville	do.		---	---	---	---	---	---	---	---	---	---	---	.311	.167	.028	---	.010	---	---	---	---
										Parts per million												
Loyalsock Creek at Loyalsock	July 20, 1944	103	68	4	7.0	5.08	3.0	---	---	---	6.0	1.4	1.1	13	10	1.2	0.0	0.5	31	21	10	---
Muncy Creek at Sonestown	Aug. 31	2.21	66	7	7.1	4.54	3.0	---	.02	---	.6	1.0	1.6	13	7.6	1.8	.1	.2	28	18	7	---
Muncy Creek near Muncy	Sept. 14, 1945	154.0	65	5	6.7	6.70	4.1	---	.01	---	2.4	2.0	---	19	9.3	2.1	.1	3.0	41	29	14	---
White Deer Creek at White Deer	do.	21.5	64	18	6.7	3.75	3.7	---	.02	---	4.5	1.5	---	17	3.3	.9	.1	.4	26	17	3	---
Buffalo Creek at Lewisburg	July 14		70	7	7.3	20.3	---	---	---	---	---	---	---	101	13	1.5	---	4.3	---	98	15	---
										Equivalents per million												
Loyalsock Creek at Loyalsock	July 20, 1944	103	---	---	---	---	---	---	---	---	.299	0.115	0.049	0.213	0.208	0.034	0.000	0.008	---	---	---	---
Muncy Creek at Sonestown	Aug. 31	2.21	---	---	---	---	---	---	---	---	.220	.082	.039	.213	.158	.031	.005	.003	---	---	---	---
Muncy Creek near Muncy	Sept. 14, 1945	154.0	---	---	---	---	---	---	---	---	.119	.164	---	.311	.194	.059	.005	.048	---	---	---	---
White Deer Creek at White Deer	do.	21.5	---	---	---	---	---	---	---	---	.225	.123	---	.279	.069	.025	.005	.000	---	---	---	---
Buffalo Creek at Lewisburg	July 14		---	---	---	---	---	---	---	---	---	---	---	1.665	.271	.042	---	.000	---	---	---	---

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Source	Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	Turbidity	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Non-carbonate	Total acidity as H_2SO_4
Lehigh River at Stoddartsville	Oct. 1, 1944	1,[illegible]	47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0	0.1	0.1	27	13	0	---
at Tannery	do.	4[illegible]	4[illegible]	[illegible]	[illegible]	[illegible]	.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.1	.1	.[illegible]	29	12	0	---
near Rockport	Nov. 1, [illegible]	[illegible]	4[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0	[illegible]	14	9	---
at Lehighton	Oct. 31, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	.[illegible]	58	33	30	16
at Catasauqua	Oct. [illegible], [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	1.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lehigh River at Stoddartsville	Oct. 31	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
at Tannery	[illegible], [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
near Rockport	Nov. 1, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
at Lehighton	Oct. [illegible], [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
at Catasauqua	Oct. [illegible], [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lehigh River at Catasauqua	Oct. 31, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]	76	45	36	---
at Glendon	Oct. [illegible], [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.[illegible]	116	73	60	---
Tobyhanna Creek near Blakeslee Corners	Oct. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.[illegible]	[illegible]	10	5	--
Bear Creek near Bear Creek	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1	[illegible]	9	7	---
Hunter Run near Rockport	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0	[illegible]	192	192	152
Lehigh River at Catasauqua	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
at Glendon	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1	.0	.139	[illegible]	[illegible]	[illegible]
Tobyhanna Creek near Blakeslee Corners	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.011	.000	[illegible]	[illegible]	[illegible]
Bear Creek near Bear Creek	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1[illegible]	.0[illegible]	[illegible]	[illegible]	[illegible]
Hunter Run near Rockport	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0	.016	[illegible]	[illegible]	[illegible]
Black Creek near Weatherly	Oct. 31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.[illegible]	0.0	255	131	181	90
Black Creek at Weatherly	Nov. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1	.2	396	280	280	80
Quakake Creek near Hudsondale	Oct. 31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.4	-	1.2	---	12	1	---
Tributary of Quakake Creek at Hudsondale	Nov. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.2	---	292	292	382
Nesquehoning Creek near Mauch Chunk	Oct. 31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0	.1	.2	495	362	362	91
Black Creek near Weatherly	Oct. 31	[illegible]	---	---	---	---	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	---	---	---	---
Black Creek at Weatherly	Nov. 1	[illegible]	---	---	---	---	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	---	---	---	---
Quakake Creek near Hudsondale	Oct. 31	[illegible]	---	---	---	---	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	---	---	---	---
Tributary of Quakake Creek at Hudsondale	Nov. 1	[illegible]	---	---	---	---	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	---	---	---	---
Nesquehoning Creek near Mauch Chunk	Oct. 31	[illegible]	---	---	---	---	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	---	---	---	---
Nesquehoning Creek near Mauch Chunk	Nov. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.1	0.2	332	200	265	88
Mahoning Creek at Lehighton	do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	.0	2.7	32	17	5	---
Pohopoco Creek near Carbon	do.	71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.1	---	1.7	---	12	2	---
Pohopoco Creek near Parryville	Oct. 31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.0	1.0	1.4	21	12	5	---
Wild Creek at Hatchery	Nov. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.0	1.1	.1	.1	14	6	1
Nesquehoning Creek near Mauch Chunk	Nov. 1	[illegible]	---	---	---	---	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	---	---	---	---
Mahoning Creek at Lehighton	do.	[illegible]	---	---	---	---	---	---	---	---	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	---	---	---	---
Pohopoco Creek near Carbon	do.	91	---	---	---	---	---	---	---	---	---	---	---	---	---	.027	---	---	---	---
Pohopoco Creek near Parryville	Oct. 31	---	---	---	---	---	---	---	---	---	[illegible]	[illegible]	0.050	.151	.063	.023	.003	---	---	---
Wild Creek at Hatchery	Nov. 1	30.4	---	---	---	---	---	---	---	---	[illegible]	[illegible]	.052	.005	.02	.03	.021	.005	.002	---

Estimated.

Source	Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (Kx10⁶ at 25°C.)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Total acidity as H_2SO_4
											Parts per million												
Cross Run at Hatchery	Nov. 1, 1945	[a]26	47	7	6.3	1.35	---	---	---	---	---	---	---	---	14	---	0.6	---	0.0	---	8	0	---
Lizard Creek near Bowmanstown	Oct. 31	---	53	10	7.1	5.58	5.8	---	0.03	0.00	6.0	2.0	1.8	0.6	22	5.6	1.8	0.1	2.0	36	25	7	---
Do.	Nov. 1	39.8	50	9	7.2	5.65	---	---	---	---	---	---	---	---	24	---	---	---	---	---	---	---	---
Aquashicola Creek at Palmerton	Oct. 31	90	55	8	7.2	19.7	6.3	---	.23	.20	23	4.7	4.5	1.0	28	60	3.0	.0	1.6	124	77	54	---
Do.	Nov. 1	73	53	4	3.69	10.3	---	---	---	---	---	---	---	---	0	135	3.0	---	1.6	---	195	195	50
											Equivalents per million												
Cross Run at Hatchery	Nov. 1	[a]26	---	---	---	---	---	---	---	---	---	---	---	---	0.229	---	0.017	---	0.000	---	---	---	---
Lizard Creek near Bowmanstown	Oct. 31	---	---	---	---	---	---	---	---	---	0.299	0.164	0.078	0.015	.361	0.117	0.051	0.005	0.032	---	---	---	---
Do.	Nov. 1	39.8	---	---	---	---	---	---	---	---	---	---	---	---	.393	---	---	---	---	---	---	---	---
Aquashicola Creek at Palmerton	Oct. 31	90	---	---	---	---	---	---	---	---	1.14	.387	.196	.026	.459	1.249	.085	.000	.026	---	---	---	---
Do.	Nov. 1	73	---	---	---	---	---	---	---	---	---	---	---	---	.000	4.000	.085	---	.026	---	---	---	---
											Parts per million												
Hokendauqua Creek at Petersville	Nov. 1	[a]5	52	9	6.8	1.3	---	---	---	---	---	---	---	---	32	27	2.2	---	3.1	---	45	19	---
Hokendauqua Creek at Northampton	Oct. 31	[a]15	64	5	7.4	20.2	---	---	---	---	---	---	---	---	90	62	3.5	---	5.4	---	126	52	---
Hokendauqua Creek at Northampton	Nov. 1	35.7	53	8	7.1	30.5	6.0	---	0.11	0.00	43	7.7	6.1	2.1	86	55	4.2	0.1	9.6	186	139	68	---
Coplay Creek near Catasauqua	Oct. 31	[a]5	[a]50	5	8.1	7.4	---	---	---	---	80	20	15	---	[b]175	112	[a]5	---	16	366	282	138	---
Little Lehigh River near Emaus	do.	---	52	4	7.4	22.9	---	---	---	---	---	---	---	---	135	17	[a]3	---	8.4	---	---	---	---
											Equivalents per million												
Hokendauqua Creek at Petersville	Nov. 1	[a]5	---	---	---	---	---	---	---	---	---	---	---	---	0.524	0.002	0.062	---	0.050	---	---	---	---
Hokendauqua Creek at Northampton	Oct. 31	[a]15	---	---	---	---	---	---	---	---	---	---	---	---	1.475	1.291	.059	---	.087	---	---	---	---
Hokendauqua Creek at Northampton	Nov. 1	35.7	---	---	---	---	---	---	---	---	2.146	0.633	0.265	0.056	1.409	1.312	.118	0.005	.150	---	---	---	---
Coplay Creek near Catasauqua	Oct. 31	[a]5	---	---	---	---	---	---	---	---	3.992	1.645	---	---	2.868	2.330	.192	---	.282	---	---	---	---
Little Lehigh River near Emaus	do.	---	---	---	---	---	---	---	---	---	---	---	---	---	2.212	.354	.107	---	.136	---	---	---	---
											Parts per million												
Little Lehigh River at Allentown	Oct. 31	---	52	5	7.5	31.0	---	---	---	---	---	---	---	---	160	19	4.0	---	11	---	156	25	---
Little Lehigh River near Allentown	Nov. 1	95	55	6	7.7	27.5	7.4	---	0.02	0.00	38	15	3.5	1.6	143	14	3.9	0.0	13	160	142	24	---
Cedar Creek at Allentown	Oct. 31	[a]10	51	8	7.8	32.4	7.5	---	.02	.00	40	16	2.8	1.3	170	19	3.8	.0	12	192	171	31	---
Jordan Creek near Allentown	do.	42	52	10	7.4	24.3	6.0	---	.01	.00	30	10	4.2	1.8	90	32	3.0	.1	12	147	116	42	---
Monocacy Creek at Bethlehem	do.	43	51	7	7.8	40.0	5.0	---	.05	.00	51	19	4.0	1.8	175	49	1.5	.1	14	237	205	62	---
											Equivalents per million												
Little Lehigh River at Allentown	Oct. 31	---	---	---	---	---	---	---	---	---	---	---	---	---	2.622	0.396	0.113	---	0.177	---	---	---	---
Little Lehigh River near Allentown	Nov. 1	[a]5	---	---	---	---	---	---	---	---	1.907	1.234	0.152	0.041	2.344	.291	.111	0.000	.210	---	---	---	---
Cedar Creek at Allentown	Oct. 31	[a]10	---	---	---	---	---	---	---	---	2.000	1.316	.122	.033	2.786	.396	.107	.000	.194	---	---	---	---
Jordan Creek near Allentown	do.	42	---	---	---	---	---	---	---	---	1.497	.822	.103	.046	1.475	.666	.085	.005	.194	---	---	---	---
Monocacy Creek at Bethlehem	do.	[a]5	---	---	---	---	---	---	---	---	2.544	1.562	.174	.046	2.868	1.030	.107	.005	.226	---	---	---	---
											Parts per million												
Saucon Creek at Hellertown	Oct. 31	---	51	5	7.0	---	---	---	---	---	30	15	4.0	---	142	1	4.0	---	7.0	---	137	20	---
											Equivalents per million												
Saucon Creek at Hellertown	Oct. 31	---	---	---	---	---	---	---	---	---	1.497	1.234	---0.117---		2.327	.021	0.113	---	0.113	---	---	---	---

[a] Estimated.

[b] Excess equivalents of [illegible] parts per million [illegible] (SO_4).

Beaver River Basin

Analyses of water samples collected during period of low flow, September 1946

Source	Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate
									Parts per million										
Shenango River at Pymatuning Dam	Sept. 26, 1946	219	66	8	6.6	12.9	0.6	0.02	14	3.6	2.3	33	22	1.2	0.1	3.1	80	49	22
at Sharpsville	-- Do.	230	66	8	6.7	14.4	.8	.01	17	4.2	4.2	46	23	3.2	.1	3.0	89	60	22
at Newcastle	Sept. 25	243	71	10	6.8	20.0	2.2	.01	23	4.9	8.9	50	38	8.2	.2	5.2	125	78	37
Beaver River at Wampum	Sept. 26	736	74	9	6.6	45.2	4.6	.08	51	10	23	43	140	21	1.1	5.0	295	166	133
at New Brighton	Sept. 21-30	803	74	7	6.5	48.5	2.6	.02	54	10	27	34	133	28	1.1	9.2	316	176	148
									Equivalents per million										
Shenango River at Pymatuning Dam	Sept. 26	219	---	---	---	---	---	---	0.699	0.296	0.101	0.541	0.458	0.034	0.005	0.050	---	---	---
at Sharpsville	--Do.	230	---	---	---	---	---	---	.848	.345	.183	.754	.479	.090	.005	.048	---	---	---
at Newcastle	Sept. 25	243	---	---	---	---	---	---	1.148	.403	.385	.819	.791	.231	.011	.084	---	---	---
Beaver River at Wampum	Sept. 26	736	---	---	---	---	---	---	2.545	.822	.984	.705	2.915	.592	.058	.001	---	---	---
at New Brighton	Sept. 21-30	803	---	---	---	---	---	---	2.695	.922	1.165	.557	3.186	.733	.058	.148	---	---	---
									Parts per million										
Little Shenango River above Salem	Sept. 26	7.1	60	8	7.7	29.4	5.6	0.01	41	9.3	6.2	140	26	3.5	0.1	0.5	168	141	19
at Greenville	--Do.	10	60	12	7.8	26.5	5.0	.00	36	8.2	4.2	132	23	3.4	.1	.7	154	128	20
Crooked Creek near Osgood	--Do.	3.2	59	23	7.2	24.0	6.6	.01	34	6.9	5.1	117	21	3.4	.1	1.9	146	113	17
Big Run near Shenango	--Do.	.4	57	12	7.4	31.5	.8	.02	41	11	3.7	131	41	3.2	.2	.7	181	148	40
Pymatuning Creek at Orangeville	--Do.	3.5	65	9	7.6	31.5	2.8	.01	40	10	11	141	37	6.6	.1	.8	184	141	25
									Equivalents per million										
Little Shenango River above Salem	Sept. 26	7.1	---	---	---	---	---	---	2.046	0.765	0.268	2.426	0.541	0.099	0.005	0.008	---	---	---
at Greenville	--Do.	10	---	---	---	---	---	---	1.796	.674	.184	2.163	.479	.096	.005	.011	---	---	---
Crooked Creek near Osgood	--Do.	3.2	---	---	---	---	---	---	1.697	.567	.222	1.917	.437	.096	.005	.031	---	---	---
Big Run near Shenango	--Do.	.4	---	---	---	---	---	---	2.046	.905	.162	2.147	.854	.090	.011	.011	---	---	---
Pymatuning Creek at Orangeville	--Do.	3.6	---	---	---	---	---	---	1.996	.822	.467	2.311	.770	.186	.005	.013	---	---	---
									Parts per million										
Cool Spring Creek at Mercer	Sept. 26	6.9	53	4	7.5	62.9	6.4	0.01	84	20	9.4	121	221	4.3	0.1	0.9	442	316	217
Otter Creek at Mercer	Sept. 25	3.9	66	10	7.9	25.5	5.5	.01	32	7.4	9.3	121	22	5.2	.1	1.2	144	110	11
Neshannock Creek at Neshannock Falls	--Do.	37	64	7	7.6	51.5	5.2	.02	68	18	11	143	131	9.2	.1	.8	335	244	126
at Newcastle	--Do.	42	70	8	8.1	46.7	4.0	.02	62	17	9.6	136	113	11	.1	.6	299	225	113
Little Neshannock Creek near Neshannock Falls	--Do.	3.1	68	8	7.8	31.5	4.2	.01	40	8.1	13	134	33	9.4	.2	2.9	181	133	23
									Equivalents per million										
Cool Spring Creek at Mercer	Sept. 26	6.9	---	---	---	---	---	---	4.192	2.138	0.409	1.983	4.601	0.135	0.005	0.015	---	---	---
Otter Creek at Mercer	Sept. 25	3.9	---	---	---	---	---	---	1.597	.608	.406	1.983	.458	.147	.005	.019	---	---	---
Neshannock Creek at Neshannock Falls	--Do.	37	---	---	---	---	---	---	3.393	1.481	.476	2.344	2.727	.260	.005	.013	---	---	---
at Newcastle	--Do.	42	---	---	---	---	---	---	3.094	1.398	.417	2.231	2.353	.310	.005	.010	---	---	---
Little Neshannock Creek near Neshannock Falls	--Do.	3.1	---	---	---	---	---	---	1.996	.666	.544	2.196	.687	.265	.011	.047	---	---	---
									Parts per million										
Big Run at Newcastle	Sept. 26	2.3	53	5	7.8	54.1	6.0	0.02	75	16	10	215	83	8.6	0.1	1.0	327	253	77
Mahoning River at Newcastle	--Do.	445	64	11	6.5	58.4	5.2	.04	62	12	34	33	195	32	1.0	.4	382	204	177
Connoquenessing Creek at Butler	Sept. 25	1.8	66	3	7.6	599	5.2	.04	201	54	877	36	115	1,900	.0	2.3	3,410	923	894
near Eidenau	--Do.	24	63	10	7.4	202	1.4	.04	186	30	208	91	439	340	2.0	28	1,330	587	513
at Hazen	Sept. 26	29	65	5	7.3	169	2.2	.03	143	29	171	84	357	280	1.6	10	1,070	476	407
									Equivalents per million										
Big Run at Newcastle	Sept. 26	2.3	---	---	---	---	---	---	3.743	1.316	0.456	3.524	1.728	0.242	0.005	0.016	---	---	---
Mahoning River at Newcastle	--Do.	445	---	---	---	---	---	---	3.094	.987	1.481	.541	4.060	.902	.053	.006	---	---	---
Connoquenessing Creek at Butler	Sept. 25	1.8	---	---	---	---	---	---	14.022	4.441	38.144	.590	2.394	53.586	.000	.037	---	---	---
near Eidenau	--Do.	24	---	---	---	---	---	---	9.281	2.467	9.029	1.491	9.140	9.589	.105	.452	---	---	---
at Hazen	Sept. 26	29	---	---	---	---	---	---	7.136	2.385	7.431	1.377	7.433	7.897	.084	.161	---	---	---

Source	Date of collection	Discharge (second-feet)	Temperature (°F.)	Color	pH	Specific conductance (micro mhos at 25°C.)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	
																		Total	Non-carbonate
									Parts per million										
Conoquenessing Creek at Ellwood City	Sept. 23, 1940	64	66	8	6.7	80.7	1.8	0.02	20	16	61	64	207	90	0.2	2.6	346	265	213
Bonnie Brook near Butler	Sept. 25	.6	62	7	7.3	107	4.2	.02	27	20	216	98	45	455	.0	.8	614	299	219
Thorn Creek near Renfrew	Do.	3.3	61	7	7.4	165	3.6	.02	61	19	211	93	20	455	.0	1.3	698	290	204
Freak Neck Creek near Eldenau	Do.	1.0	46	13	7.1	96.2	3.8	.02	43	13	124	140	36	102	.2	9.5	528	176	45
Little Conoquenessing Creek at Little Conoquenessing	Do.	2.1	51	7	7.2	87.1	1.8	.02	42	13	106	48	71	104	.1	.9	458	158	119
									Equivalents per million										
Conoquenessing Creek at Ellwood City	Sept. 25	64	---	---	---	---	---	---	3.690	1.316	2.12	1.014	4.310	2.57	0.011	0.042	---	---	---
Bonnie Brook near Butler	Sept. 25	.6	---	---	---	---	---	---	2.141	1.645	9.392	1.606	.937	12.832	.000	.013	---	---	---
Thorn Creek near Renfrew	Do.	3.3	---	---	---	---	---	---	3.041	1.562	9.179	1.521	.416	12.832	.000	.021	---	---	---
Freak Neck Creek near Eldenau	Do.	1.0	---	---	---	---	---	---	2.145	1.069	5.391	2.292	.437	7.435	.011	.153	---	---	---
Little Conoquenessing Creek at Little Conoquenessing	Do.	2.1	---	---	---	---	---	---	2.095	1.054	4.604	.787	1.078	5.471	.005	.016	---	---	---
									Parts per million										
Brush Creek near Hazen	Sept. 25	0.7	54	3	7.2	42.0	3.2	.04	9	11	2	47	62	68	0.1	0.5	277	143	112
Slippery Rock Creek near Slippery Rock	Sept. 26	16	68	5	7.9	59.8	4.2	.01	72	13	10	74	142	63	.2	.5	304	233	172
at Wurtenburg	Sept. 25	52	59	9	7.9	41.2	2.6	.02	49	10	10	107	71	18	.2	1.0	247	143	59
Wolf Creek near Slippery Rock	Sept. 25	15	65	10	7.8	34.7	2.4	.03	40	9.1	1	117	43	11	.2	4.6	199	137	17
Muddy Creek near Grant City	Do.	2.5	64	8	7.3	42.1	5.6	.02	47	12	1	67	104	20	.2	1.0	262	167	99
									Equivalents per million										
Brush Creek near Hazen	Sept. 25	0.7	---	---	---	---	---	---	1.945	0.905	1.103	0.800	1.707	1.910	0.003	---	---	---	---
Slippery Rock Creek near Slippery Rock	Sept. 26	16	---	---	---	---	---	---	3.591	1.069	1.086	1.222	3.711	.031	.008	---	---	---	---
at Wurtenburg	Sept. 25	52	---	---	---	---	---	---	2.441	.822	.870	2.001	1.481	.508	.011	---	---	---	---
Wolf Creek near Slippery Rock	Sept. 25	15	---	---	---	---	---	---	1.996	.740	.078	1.910	.729	.310	.011	---	---	---	---
Muddy Creek near Grant City	Do.	2.5	---	---	---	---	---	---	2.391	.987	.043	1.360	2.115	.564	.011	---	---	---	---

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Analyses of water samples from miscellaneous sources in Pennsylvania, 1944-46

Source	Date of collection	Discharge (second-feet)[1]	Temperature (°F.)	Color	pH	Specific conductance ($K \times 10^6$ at 25°C.)	Parts per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$	Total acidity as H_2SO_4	Equivalents per million: Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Total hardness as $CaCO_3$
Schuylkill River at Auburn	Aug.22,1944--	100	74	---	4.2	115	---	---	---	---	---	---	---	---	---	---	---
at Hamburg	----do.------	250	72	---	4.1	103	---	---	---	---	---	---	---	---	---	---	---
Little Schuykill River at Tamaqua	----do.------	2	---	---	4.2	55.9	---	---	---	---	---	---	---	---	---	---	---
at Moline	----do.------	150	72	---	4.1	116	---	---	---	---	---	---	---	---	---	---	---
Allegheny Creek near Gibraltar	Mar.17,1945--		51	7	7.2	8.84	27	17	2	2.3	34	---	0.443	0.354	0.056	0.037	0.680
Sugar Creek near Luthers Mills	July 13,1945-	5-10	69	8	7.6	18.2	79	23	5	.2	72	---	1.295	.479	.141	.003	1.440
Bowman Creek near Eatonville	Dec. 9,1944--		36	---	6.7	6.93	15	11	4	---	21	---	.246	.229	.113	---	.420
Falls Creek at Falls	Sept.22------		62	---	7.4	17.5	64	25	6	---	64	---	1.049	.520	.169	---	1.280
----------Do.	Dec. 9-------		---	---	7.2	12.7	27	28	3	---	51	---	.443	.583	.085	---	1.020
Lackawanna River near Forest City	Mar.19,1945--		40	13	6.5	4.02	9	8	1	.8	16	---	.148	.167		.013	.320
at Archbald	Sept.22,1944-		59	---	3.40	42.4	0	---	2	---	---	---	---	---	.056	---	---
----Do.	Mar.19,1945--		42	3	4.5	15.7	0	60	.5	---	---	11	.000	1.249	.014	---	---
at Duryea	Dec. 9,1944--		40	---	4.20	47.3	0	217	4	---	---	---	---	4.518	.113	---	---
----Do.	Mar.19,1945--		45	1	3.75	40.1	0	162	2	---	132	39	.000	3.373	.056	---	2.640
Nescopeck Creek at Nescopeck	Sept.8,1945--	75-100	75	4	3.0	126	0	611	1	.1	435	312	.000	12.721	.028	.002	8.700
Catawissa Creek near Catawissa	----do.------		74	1	3.4	52.2	0	231	2	.8	120	136	.000	4.809	.056	.013	2.400
Shamokin Creek at Sunbury	Dec.11,1944--		36	---	3.30	67.9	0	278	5	---	---	---	---	5.788	.141	---	---
----------Do.	Mar.20,1945--		58	---	3.00	117	0	467	9.5	---	352	174	.000	9.723	.268	---	7.040
----------Do.	Sept.8-------	50-60	73	4	2.9	170	0	770	17	.1	660	230	.000	16.032	.479	.002	13.200
Mahanoy Creek near Herndon	Dec.11,1944--		36	---	3.45	75.6	0	375	2	---	---	---	---	7.808	.056	---	---
----------Do.	Mar.20,1945--		57	---	3.40	100	0	502	1	---	375	164	---	10.451	.028	---	7.500
----------Do.	Sept.8-------	40-50	72	4	3.2	191	0	1,160	2	---	1,140	320	.000	24.150	.056	---	22.800
Wiconisco Creek at Millersburg	Dec.11,1944--		37	---	6.1	14.2	10	60	3	---	54	---	.164	1.249	.085	---	1.080
----------Do.	Mar.20,1945--		57	---	5.7	32.3	4	138	3	3.0	---	---	.066	2.873	.085	.048	---
----------Do.	Sept.8-------	30	71	5	5.9	49.2	14	236	2	4.0	255	---	.229	4.914	.056	.065	5.100
Yellow Creek near Hopewell	Sept.19,1946-		66	7	8.1	31.5	184	---	---	1.7	---	---	3.016	---	---	.100	---
Codorus Creek near Menges Mills	July 10,1945-	5-8	75	5	6.7	9.11	33	---	---	---	---	---	.541	---	---	---	---
near Stoverstown	----do.------	20-25	80	1,800	---	110	---	---	105	---	---	---	---	---	50.766	---	---
at York	----do.------		80	260	---	36.7	---	---	31	---	---	---	---	---	.874	---	---
near Emigsville	----do.------	100	77	220	---	46.7	---	---	34	---	---	---	---	---	.959	---	---
Oil Creek at Menges Mills	----do.------	2-3	80	10	7.3	32.9	150	13	20	---	117	---	2.458	.271	.564	---	2.340
S.Br.Codorus Creek near York New Salem	----do.------	75	78	5	6.7	9.43	30	---	---	---	---	---	.492	---	---	---	---
Allegheny River at Coudersport	July 13,1945-	10	69	7	7.0	5.69	20	5	1	2.1	26	---	.328	.104	.028	.034	.520
at Port Allegheny	----do.------		72	15	6.9	8.86	25	8	7.5	1.2	33	---	.410	.167	.212	.019	.660
at Turtlepoint	Aug.25-------		67	18	6.7	10.1	33	12	7	1.4	---	---	.541	.250	.197	.023	.800
at Elred	----do.------	150	67	8	6.7	44.0	40	10	104	.2	84	---	.656	.208	2.933	.003	1.680
Potato Creek at Coryville	----do.------		67	7	6.7	72.4	46	14	188	.1	138	---	.754	.291	5.302	.002	2.760
Sugar Creek near Franklin	Sept.25,1946-		63	9	7.6	19.1	91	---	---	.8	---	---	1.491	---	---	.013	---
Buffalo Creek at Worthington	Mar.23,1945--	150	42	---	6.1	11.0	9	33	6	2.2	40	---	.148	.687	.169	.035	.800
Lake Erie at Erie[1]	July 5-------		---	---	7.9	27.1	107	20	18	1.0	117	---	1.754	.416	.508	.016	2.340
Tioga River at Mansfield	July 13------		67	3	3.25	59.0	0	212	4	.6	---	88	.000	4.414	.113	.010	---

[1] Estimated.

[2] Silica (SiO_2), 1.0; iron (Fe), 0.01; calcium (Ca), 34; magnesium (Mg), 7.9; sodium (Na), 7.2; potassium (K), 1.1 parts per million.

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*10—Drainage Basin Study. 3 vols., 611 pages, 1937.

11—Planning and Zoning Powers and Procedures in Pennsylvania, 1938. Vol. 1. (Townships of the Second Class, Counties, Regions.)

12—Planning and Zoning Powers and Procedures in Pennsylvania, 1938. Vol. 2. (Cities, Boroughs, First Class Townships.)

13—The Pennsylvania Zoning Primer. 1940.

14—Industrial Utility of Water. Part 1. Temperatures and Chemical Content at Low Flow. June, 1945.

15—Recent Industrial Trends and New Employment Opportunities in Pennsylvania, 1944.

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Soil Conservation, September, 1947.

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DOCUMENTS SECTION

PENNSYLVANIA
DEPARTMENT OF COMMERCE
STATE PLANNING BOARD

THE PENNSYLVANIA ZONING PRIMER

VOLUME NUMBER 3

PLANNING & ZONING POWERS & PROCEDURES

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THE PENNSYLVANIA ZONING PRIMER

VOLUME 3

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THE PENNSYLVANIA ZONING PRIMER

PLANNING AND ZONING—A COMMUNITY LIFE INSURANCE POLICY

The Community Plan.

Although it may not be generally realized, all governmental units—whether they be cities, boroughs or townships—indulge in the task of community planning to some degree. Sometimes it is good planning, sometimes poor planning. In some instances it may consist of the laying out of a single street or the establishment of a single facility, such as a playground. Too often such a single project is planned with no consideration of its effect on future developments in the area. On the other hand, the planning program may and should encompass the entire physical environment of the community.

A program designed to guide the orderly growth and development of the municipality should include the street system, or thoroughfare plan necessary to serve not only the existing needs of the area but also the foreseeable future developments in the area; a recreational plan covering the necessary parks and playgrounds; plans for a civic center, if needed; present and proposed schools; utilities, such as street lights, water supply, sewage collection, etc.; airports, railroad or bus terminals, and, perhaps, other elements of a transportation plan. All these things and many others should

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be considered not only on their own merits but also in relation to each other. All should be based on a clear understanding of present conditions in the area and of current trends in population growth, as well as the probability of residential, commercial and industrial development. An extremely important part of the comprehensive plan is an analysis of the local governmental unit's financial situation to serve as the basis for the scheduling of the most important projects and the deferral of those of lesser urgency.

This method of purposeful or comprehensive planning is in direct contrast to the haphazard policy of letting things go until a specific problem demands attention. The best solution of these interrelated problems depends upon judgment, foresight and common sense, in addition to the technical skills involved.

A well conceived and properly executed community plan serves as a basic pattern or framework about which existing deficiencies may be adjusted or systematic and desirable growth may occur. The benefits derived are both financial and physical, resulting from the improvement of the physical facilities which contribute to the health, happiness and general welfare of the inhabitants.

Relationship of Zoning to Comprehensive Planning.

The general community plan is concerned principally with elements public in character, such as streets, parks, schools and public buildings. Zoning, on the other hand, is concerned with the use of private property. However, the use of private property is influenced directly by the pattern of public facilities and changes in use of private property will in turn influence the development of new public facilities.

To prevent a chaotic assortment of misplaced buildings and land-uses in residential areas, such as factories, garages, outdoor advertising or junk yards, some means of public control is necessary. The zoning ordinance provides the means for imposing the required restraints on individual discretion in the public interest. By the terms of such an ordinance the

local legislative body may regulate and restrict the height and bulk of buildings, the area of yards and courts and other open spaces, and the density of population. It may also regulate and restrict the use of buildings, structures and land.

Basis of Authority for Zoning.

It is apparent that a zoning ordinance is a powerful instrument for advancing the community welfare. Because of its far-reaching effects, citizens, government officials, or other bodies may ask by what authority a community is empowered to prepare and adopt such sweeping legislation.

Zoning is done under the exercise of the power which is a basic attribute of the State. Before municipalities or townships can avail themselves of this power, it must be conferred upon them through the medium of a State enabling act.

In Pennsylvania zoning powers have been granted to every type of civil subdivision—cities, boroughs, first class townships, second class townships and counties.

The Purposes of Zoning

The purposes of zoning as stated in the Borough Code are as follows:

"ARTICLE XXIII

Section 3303. Purpose in View.—Such regulations shall be made in accordance with a comprehensive plan, and designed to lessen congestion in the streets, to secure safety from fire, panic and other dangers, to promote health and the general welfare, to provide adequate light and air, to prevent the over-crowding of land, to avoid undue concentration of population, to facilitate the adequate provision of transportation, water, sewerage, schools, parks, and other public requirements. Such regulations shall be made with reasonable consideration, among other things, to the character of the district and its peculiar suitability for particular uses, and with a view to conserving the value of buildings and encouraging the most appropriate use of land throughout the borough."

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The purposes stated or implied in the zoning enabling acts covering cities, first and second class townships, and counties are substantially the same as those enumerated above.

It is evident that an important purpose of zoning is the safe-guarding of the home by preserving the attractiveness and protecting the environment of residential areas. This is accomplished by creating residence districts in which injurious uses such as factories, laundries, public garages, or junk yards are excluded; by maintaining adequate open spaces in the form of front, rear and side yards; and by preventing the over-subdivision of lots.

The conservation of property values is another important purpose of zoning. In unzoned communities, the instability of residence districts makes the investment in a home a hazardous venture and accordingly discourages home ownership. The invasion of specific sections of a municipality, either business or residential, by inappropriate uses results in many good buildings becoming prematurely obsolete, because they have ceased to be appropriate improvements for the location, with consequent economic loss. Any measures taken to preserve the integrity of a district will assist in stabilizing the value of land and buildings.

The limitation and prevention of congestion is another important purpose of zoning. This is a serious problem in many communities. Over-intensity of use of the land has caused congestion of population which in turn is responsible to a great degree for street, school and transit congestion. Buildings which cover too great a percentage of the area of a lot are built to an excessive height and thus provide space for an excessive number of people on a given area. Congested dwellings in business and industrial districts, or in close proximity thereto, are especially injurious, and may produce conditions inimical to health, safety, morals and the general welfare. Existing housing congestion cannot be greatly reduced by zoning, but the spread of such conditions to other sections can be prevented by appropriate regulations requiring a specified lot area for each family for which a multiple-residence or apartment house is designed.

Basic Principles

It is to be observed that the purposes in view are subject to two limitations. First, the regulations must be based on consideration of community health, safety, convenience, morals or general welfare. Second, the regulations are to be made in accordance with a comprehensive plan. These requirements of "public welfare" and "comprehensive planning" are essential for a properly balanced zoning plan and for a legal ordinance. In addition the regulations cannot be discriminatory or unreasonable. The criterion of reasonableness is to be kept constantly in mind during the preparation of zoning regulations.

All zoning, if it is to be effective and is to merit the support of the courts, must conform to these basic principles. The following are some of the things to be kept in mind when preparing new ordinances or revising old ones, and in administering ordinances once adopted.

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PRINCIPLES TO BE OBSERVED IN DRAFTING AN ORDINANCE

1. *Zoning should be undertaken only with public support.*

Neglect of this factor vital to the success of any program of community planning and self-protection has resulted in more disappointment than all other causes combined.

The success of zoning under Pennsylvania Law in promoting safe and orderly growth and protecting property values in the hundreds of communities, large and small, where it is being practiced, is a powerful argument for its adoption.

This means little, however, to those who do not understand what zoning really means—what it can do for a community's protection, how it can promote orderly growth, maintain property values, protect residential areas, and strengthen the tax base.

To insure general support for a zoning program, these facts must be brought to public attention, through newspaper publicity and at open meetings at which citizens of communities now enjoying zoning protection can be invited to share their experiences and answer the questions that are certain to arise. With the backing of public opinion, the drafting, adoption, and effective administration of a zoning ordinance will be greatly simplified.

2. *Zoning must be reasonable.*

The zoning commission has no more right than any other public body to confiscate property, or destroy property values. Its authority is granted for the purpose,

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among others, of improving or maintaining such values. Zoning should be no more restrictive than is necessary to accomplish its essential objectives.

3. Zoning should be based on complete information.

Good zoning is not a thing by itself, but a part of comprehensive community planning. In the long-run it will operate most satisfactorily, will be least subject to change, and will be more generally supported by the courts, if based upon a comprehensive community plan, and if done in conjunction with comprehensive planning. Intelligent zoning requires the same intimate knowledge of conditions and trends—of things as they are and as they are likely to be—as is required for wise planning. It is not only better but more economical to combine the zoning and planning jobs.

4. Zoning should be individual.

While the principles involved are the same for all communities of whatever size, every zoning ordinance is as much a special problem as every prescription written by a good doctor. There are no patent medicines and no cure-alls that can be applied to any community's problem. Every town, however small, has its own character and preferences, and every rural district its own peculiar conditions and customs. The individuality of the locality and of local circumstances must be taken into account in zoning ordinance drafting, if zoning is to be beneficial.

5. Proper zoning cannot be attained by copying the ordinances of any other community.

Careful study may sometimes show that only a relatively few changes are needed to adapt a borrowed ordinance to local use, but these changes, no matter how few,

may be extremely important to the interests of many people. Also, most ordinances contain a number of not-easily-detected compromises, forced by local sentiment or by peculiar local conditions. The uninformed copier may well take the unnecessary and the bad, along with the good, when he undertakes to shortcut procedures by accepting a "hand-me-down" ordinance. The only exception to these statements is to be found in the introductory and administrative clauses of zoning ordinances, the form of which is largely standardized by the terms of the State enabling acts.

6. *The vital problem of zoning is to determine the needed number and kinds of districts, and where the limits of each district should fall.*

Such important facts cannot be arrived at from the ordinances of any other community. Their determination has to be based on a complete knowledge of each community's needs and prospects. A comprehensive plan for the locality's present and future development has to be arrived at first. Few communities require identical zoning districts, either in kind or number, and the exact point at which one district should end and another begin is obviously a matter of great local importance.

Volumes I and II of this series,—the former dealing primarily with rural areas and the latter with urban areas, —should be consulted for more detailed information.

7. *It is better to have the areas allotted to business and industry too small than too large.*

The general tendency of zoning bodies is to place far more land under business and industrial classifications than is justified by reasonable probability of growth and development. Zoning in which business and industrial areas are made too large has the effect of denying residen-

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tial protection to areas without real business or industrial prospects and, at the same time, of discouraging further residential investment in them. Then follow depreciation of property values, blight, and slums—the very things that zoning is intended to prevent. Business and industrial districts should be sufficiently extensive to permit healthy growth, and should include enough undeveloped frontage to avoid conferring a monopoly upon owners of established business and industrial properties; but any large expansion of these districts is usually harmful, not only to the community as a whole, but also to the property owners affected. In this connection, it is well to remember that it is much easier, and less disturbing to property investments, to change an area from a more restricted district to a less restricted district than it is to reverse the process. When in doubt, a given piece of land should be placed in the more restricted district.

8. The kinds of districts should be as few as possible.

Their number may vary from as few as two or three to as many as seven or more, depending upon the range of present and prospective development. But it is a safe rule to set up no more differing types of districts than seem necessary to accomplish local zoning objectives.

9. Zoning should provide the best possible location for each type of use necessary in the community. It should not exclude any legitimate building or use from an appropriate location.

The "place" requirements of all buildings and of all activities normal and essential to present-day life must be recognized and suitably provided for. This does not mean that every municipality must provide a place within its own boundaries for every known type of building and use, but that if any class of use is excluded, it should be

for some good and supportable reason. As illustration: a characteristically high-class residential community, part of a larger and more complete social and economic community, may completely exclude industry and certain residential types upon the grounds that more suitable location for such development is to be found elsewhere in the same general locality, but such a condition should be noted and supported in the zoning commissioner's report to the governing body.

10. Good zoning allows for improvement in construction and housing practices.

It must not prevent any beneficial developments by too rigid regulations. Zoning is directed chiefly toward regulating average or usual procedures. Its standard front, side, and rear yard provisions, for instance, are designed to govern the location of individual structures on individual lots. The same kind of regulation is not equally applicable to large-scale developments, where a number of houses are built at the same time by the same owner, and where best and most pleasing results can oftentimes be obtained by disregarding lot lines and providing needed open space in some shape and form other than the usual front, side and rear yards. Every ordinance should provide, under proper safeguards, for such advantageous departures from standard types of construction. In other words, good zoning will not stand in the way of improved procedures.

11. Zoning should disregard existing property lines and the present ownership of the land.

Other considerations such as the proper depth of lot for a certain kind of use, the character of existing development, the suitability of land for a given purpose, the nature of protection desired, should be the controlling

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factors in deciding upon district limits. It is usually inadvisable to use the center-line of streets as the boundary of zoning districts. Conditions under which one side of a street is zoned for residence and the other side for business or industry are obviously not often well adapted to good community living. The rear property line of a block frequently makes a sounder district boundary than a street front.

12. Zoning of rural and semi-rural areas involves a number of special considerations,—

a. First there is the problem of achieving desired results without undue interference with normal farming operations. Usually, in open country, no restrictions need be placed upon farm activities beyond those needed to keep buildings a specified distance back from the road.

b. An exception to the above statement may occur in the case of submarginal lands in areas remote from metropolitan influence. As permitted under enabling legislation, it may sometimes be necessary to prohibit the use of certain areas for farming where it is evident that the land is so infertile, or so difficult of access that its use as farm land is uneconomical for the individual or the community. In other such areas, it is sometimes advisable to prohibit year-round residence because of the excessive cost of providing facilities such as schools and roads.

c. A primary use of zoning in many rural areas is for the protection of highways against detrimental frontage development. In this use of zoning, primary objectives should include the promotion of highway attractiveness, safety, and efficiency through such means as concentrating business uses in most convenient and logical locations, and keeping all buildings well back from the roads. It is a mistaken idea that all main-highway frontage is potential business property. Excessive allowance for the busi-

ness development of highway frontage in the country is as detrimental to property values and to the general public interest as is the over-provision for business in any other location.

d. Further objectives of zoning in rural areas are the preservation of rural characteristics and the prevention of purely speculative and premature subdivision of land into streets and lots. Such objectives are especially important in rural and semi-rural municipalities, at or near the fringes of large metropolitan areas. If such subdivision is allowed to occur without a real need, or a likelihood of settlement in the locality subdivided, the results are frequently very serious for the community involved. The area so subdivided is withdrawn from agricultural use and becomes unproductive. The laying out of streets and the provision for future public services may add greatly to a community's expenses. Such land frequently becomes tax delinquent, and in many cases, because of accumulated charges on the subdivider or the holders of lots, becomes the subject of expensive legal action, and a source of loss to the community.

13. Zoning should follow established principles rather closely.

Zoning is a gradually-evolving use of the police power, with its range of application and its rate of advancement being continuously determined by court decisions and interpretations. While advances are made only by moving beyond those things already sanctioned by the courts, extreme departures from established principles are hazardous and may result not only in expensive litigation but also, and more importantly, in unfavorable court action likely to do serious damage to the local ordinance and to zoning in general. Zoning, therefore, should be undertaken only with a good working familiarity with the atti-

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tude of the courts, especially that of the higher courts of the state in which the work is being done.

14. Finally, zoning is not a job for the layman.

There are few instances where it will not be found better and, ultimately, less costly to employ qualified technical assistance in drafting a zoning ordinance. The planning and zoning technician contributes his experience and his broad knowledge of the subject, as well as an objective point of view that helps to dispel local misapprehensions. The thoroughness with which he is prepared to do the job also tends to reassure the courts as to the basic soundness of an ordinance, if its provisions should ever be attacked. This is especially true if the locality has shown the wisdom and foresight to include comprehensive planning as a part of, and as a foundation for, its zoning program.

Further, while zoning has a background in law and involves a knowledge of legal processes, the drafting of a zoning ordinance is a great deal more than a legal job and requires a training and experience unusual in the practice of law. Municipal attorneys can and should be of large assistance in the establishment of zoning in a locality, but should rarely be asked to perform unaided the specialized work of preparing a zoning ordinance and map making.

II

ADMINISTRATION OF THE ZONING ORDINANCE

A good zoning ordinance does not amount to much unless well administered. Laxity in applying regulations, ill-advised granting of variances and exceptions, and too frequent and too spotty changes of the ordinance or map,

will quickly vitiate the best of ordinances. The effectiveness of zoning administration will be improved by observing the following simple rules:

1. *The first important link in zoning administration* is the zoning officer, the person who issues the zoning permits and watches for zoning violations. He has no discretion in the matter of issuing permits. If a building or use for which a permit is requested conforms to the zoning regulations, he must give a permit; if the proposed building or use does not conform to the ordinance, he must deny a permit and advise the applicant of his privilege to take an appeal to the board of adjustment. However, by being considerate and tactful in his dealings with the public, the zoning officer can prevent a great deal of friction and can save the board of adjustment from a great many unnecessary appeal cases.

2. *Next, in zoning administration,* comes the board of adjustment. The purpose of this board is to give relief in those occasional cases of unusual and unnecessary hardship which always seems incidental to the rigid enforcement of any broadly applicable law or regulation. This board also serves as a safety valve, clearing away all but the very exceptional grievances without court action, and thus saving both the aggrieved applicants and the municipality from litigation. But it may happen, and sometimes does, that, through excessive sympathy or timidity, coupled with a misunderstanding of its powers and duties, the board of adjustment will come to sanction so many variances, upon such little provocation, that the zoning ordinance is rendered virtually ineffective.

The zoning board of adjustment has power to grant variances only in specific cases where, by reason of peculiar circumstances such as an unusual shape of lot, or some condition in the use of abutting property, strict observ-

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ance of the terms of the ordinance would work a special hardship upon the owner and where the granting of a variance would not be disproportionately injurious to neighboring property. If identical or similar circumstances surround all or many properties in the same neighborhood, they are not *special* circumstances and do not comprise reason for granting a variance. The probability that an owner can realize a greater financial return by using his property contrary to zoning regulations is not in itself a sufficient reason for permitting a departure from zoning requirements.

When, in the opinion of the board of adjustment, any part of the zoning ordinance or map is unnecessary, unworkable, or unreasonable, remedy should be had by changing the ordinance and not by the repeated granting of variances and exceptions.

3. *Finally;* the continued stability and effectiveness of zoning rests with the governing body, in its power to change the ordinance. Obviously, frequent and ill-considered amendments to the ordinance are bad. Sooner or later some changes in every zoning ordinance and map become necessary; but, whenever undertaken, such changes should be given just as careful study and consideration as were given to drafting the original ordinance. All proposed amendments should be referred to the original drafting agency—the planning commission, or the zoning commission—for review and recommendation. The same principles should apply in making zoning map changes, as in making the original map. Spot zoning—the creation of many small scattered districts—should be avoided. Only rarely, and then usually only through the extension of existing boundary lines, should changes in district classification be made for individual lots or small portions of blocks.

IN CONCLUSION

IF YOU WOULD HAVE GOOD ZONING—

Get a good ordinance. That means an ordinance prepared in conjunction with comprehensive planning, and with the help of competent advice—an ordinance made to fit local conditions and needs.

Insist upon sympathetic and judicious administration. That means tactful and alert performance upon the part of the zoning officer, and the appointment of a board of adjustment that knows its powers and duties and keeps within them.

Make only such alterations in the ordinance and map as changing circumstances and administrative experience may suggest. That means giving to every proposed change the same careful considerations as was given to framing the original ordinance.

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SELECTED PUBLICATIONS OF THE PENNSYLVANIA STATE PLANNING BOARD

Publication No.

*1—Preliminary Report. 682 pages, 152 charts, December, 1934.

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17—Chemical Character of Surface Water, August, 1947.

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LOCAL POWERS FOR COMMUNITY DEVELOPMENT

VOLUME NUMBER 4

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LOCAL POWERS
FOR
COMMUNITY DEVELOPMENT

PENNSYLVANIA LEGISLATION
AUTHORIZING
LOCAL PUBLIC PLANNING,
DEVELOPMENT
AND
RECONSTRUCTION

PENNSYLVANIA DEPARTMENT OF COMMERCE
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FOREWORD

The preceding three volumes of this series PLANNINC AND ZONING POWERS AND PROCEDURES, VOLUMES 1 AND 2, and the PENNSYLVANIA ZONING PRIMER have dealt with the powers conferred on the civil subdivisions of the State to control their own development through planning and zoning commissions. Since the publication of these manuals, very considerable progress has been made by Pennsylvania communities in programs for self-development and self-improvement. Problems arising from war and war industries have stimulated the spread of planning and zoning and have also led to the creation of a number of unofficial local self-development committees.

Some account of this movement for local self-appraisal and self-development as a means for meeting the challenge of Post-War changes may be found in two publications of the State Planning Board, COMMUNITY SELF-APPRAISAL and COMMUNITY ACTION FOR LOCAL SELF-DEVELOPMENT. The use of air photographs as a basis for planning and zoning is dealt with in the issue of Pennsylvania Planning on AIR PHOTOGRAPHY. These and other publications which may be of assistance in the framing or carrying out of community planning and development programs are listed in the final page of this booklet.

Since the passage of the various Planning and Zoning Enabling Acts, additional legislation has extended the powers of local governments to control the pattern of their growth and to provide themselves with facilities necessary to increase their attractiveness for industry and business, and for residence.

Powers for community co-operation in many lines of public endeavor have been authorized by law. Means for providing recreational facilities and services, for establishing community woodlands, for providing water, sewer and electrical facilities, for protecting the safety of the highways, and for controlling the subdivision of land now exist for every type of municipality in Pennsylvania, and many of these powers have also been granted to first and second class townships.

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A new soil conservation district law enables each county in the Commonwealth to establish local control of a soil conservation program with the assistance of the State Soil Conservation Commission.

The 1945 Session of the Legislature revised the Municipal Authorities Act and extended its provisions so that a wide variety of public facilities can be created or managed by a local Authority. The new Urban Redevelopment Law permits the establishment of Redevelopment Authorities which may deal with the reconstruction of slums or blighted areas in any of the cities or counties of the State.

This publication will illustrate the scope of the powers now possessed by Pennsylvania's communities to implement their plans for the future. The list is by no means inclusive of all such enactments, but will provide ready information as to important local powers, with direct reference to the Public Laws in which these powers are more exactly defined.

Because of the limitations of space the special laws dealing with the powers of First, Second and Second Class A cities are not generally dealt with in this summary.

In general, it may be assumed that these cities, Philadelphia, Pittsburgh and Scranton, have all of the powers granted to smaller municipalities.

Specific authority to establish Planning Commissions has not yet been conferred on second class townships in the Commonwealth, although such townships are directed under the township zoning law to prepare their zoning ordinances in accordance with a comprehensive plan.

A Planning Enabling Act for second class townships might well encourage more of our rural and suburban communities to undertake a program of local self development.

Pamphlet Law numbers for Acts of the 1947 General Assembly are not available at the date of publication of this issue. 1947 Laws are referred to in our notes by Act number only.

The assistance of the Legislative Reference Bureau in reviewing this manuscript and checking the references to the Pennsylvania Statutes is gratefully acknowledged.

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Pennsylvania Legislation Authorizing Local Public Planning, Development and Reconstruction

PLANNING

Cities, boroughs, townships of the first class, and counties are empowered to establish Planning Commissions whose membership shall consist of nine persons in the case of counties and five in the case of cities, boroughs, or townships of the first class. These Commissions have the power to employ engineers and other persons, to prepare maps and plans for their area, and, in the case of cities and boroughs, within surrounding territory extending three miles beyond the corporate limits, and to make recommendations as to locations of public buildings, highways, civic centers, parking spaces, parks or any other public grounds, or any improvement or change in the corporate plan deemed advisable by them. The Commissions are charged with the responsibility of considering present conditions, future needs and probable growth in preparing their plans, which are to be submitted to the governing body of the civil divisions as recommendations for needed improvements or developments.

Under the Act of 1941, Pamphlet Law 932, the appointment of a Planning Commission or the assignment of its functions to some other official commission is mandatory for third class cities.

The power of the Township Planning Commission is limited to recommendations to the Township Commissioners, and its responsibilities are limited to making an annual report of recommendations and to presenting an opinion in regard to any plans of township de-

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velopment submitted to them by the Township Commission.

In the cities and boroughs the council must submit to the Planning Commission a copy of all ordinances, bills or amendments as to the location of public buildings, the location, widening and ornamentation of streets, parking grounds and parks, and the location of bridges, tunnels, subways or railroads. The Planning Commission has the power to disapprove of any of the ordinances, bills or amendments, but this disapproval does not act as a veto. Positive powers of the Planning Commissions in cities, boroughs and counties lie in the provision that all plans, plots or replots of land with dedications of streets and alleys necessary for use of residents thereon must be submitted to the Planning Commission and approved before they can be recorded. The Planning Commission has the authority to refuse to accept such plans, and no public sewer, water pipes or other improvements can be installed within the area for the use of such a development until the Commission does approve this plan. This power in the boroughs is limited to the borough area. In the case of cities jurisdiction extends—in general—to a point three miles beyond the corporate limits. A county Planning Commission has similar powers and responsibilities as to all plans or plots proposed to be laid out within the county outside the limits of cities, boroughs, and first class townships.

While second class townships have no specific authority to appoint a Planning Commission, their authority to develop and enact zoning ordinances specifies that such ordinances shall be "in accordance with a comprehensive plan." This in effect gives the Township Zoning Commission a directive to perform most of the functions of a Planning Commission. Supervisors are authorized to expend funds for technical assistance in preparing zoning regulations.

Regional Planning Commissions may be formed by the action of the administrative bodies of any two or more political subdivisions, under authority granted in the County and Regional Planning Enabling Act of 1937. The Regional Planning Commission may make plans, surveys and studies for the area which it represents, and may be delegated any or all of the powers and duties of the several Planning Commissions of the included area.

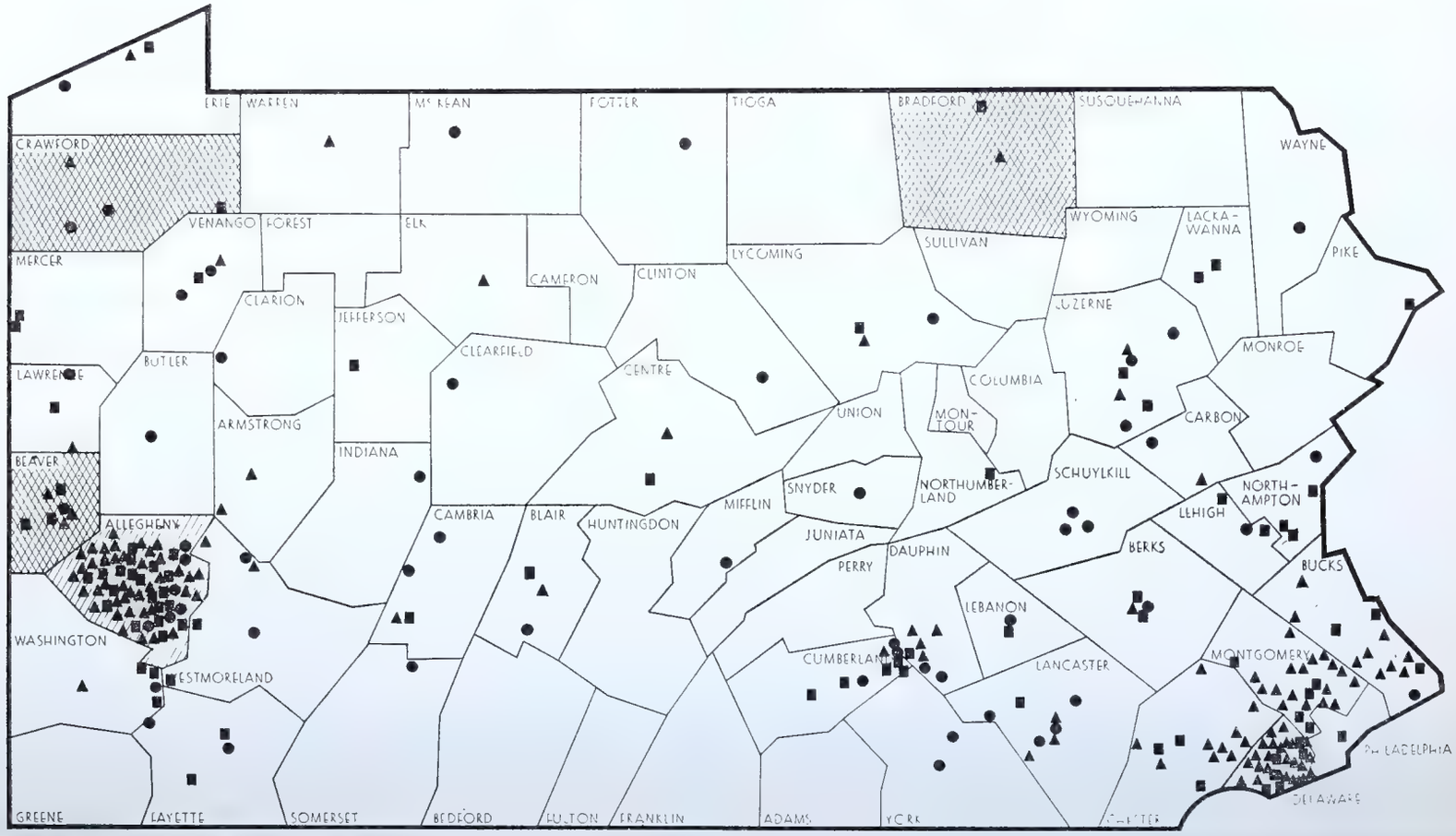
Under Acts of 1945, any adjoining cities, boroughs, towns, townships and counties may co-operate in planning, zoning, health, and recreation programs, may employ personnel such as planning engineers, may contract for professional planning services, and may purchase property and materials for joint use.

While the laws of Pennsylvania specifically authorize Commissions to prepare plans for the physical growth and development of their community, it has been evident for a number of years that a successful local plan must also be concerned with the growth of the community's commerce, industry and recreational resources, and the development of conditions under which those resources may be put to the maximum use. It is not unlikely that legislation will soon specifically extend the powers of planning bodies to consider such factors and to prepare programs for the development of local resources and the promotion of local industry. Meanwhile many active planning bodies have already undertaken such a responsibility to the great benefit of the communities in which they operate.

Counties	1937 P.L. 2124—Sec. 501-507.4
	1929 P.L. 1278—Sec. 501-506
	1947 Act 212
Cities	1931 P.L. 932—Sec. 4001-4006
Boroughs	1927 P.L. 519—Sec. 1145-1150 as amended
Townships, 1st Class	1933 P.L. 1096—Sec. 3201, 3202, 3203
Regional	1937 P.L. 2124—Sec. 507.2-507.4
	1943 P.L. 340 as amended by
	1945 P.L. 206 and P.L. 1339

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LOCATION OF LOCAL PLANNING AND ZONING ACTIVITIES IN PENNSYLVANIA NOVEMBER 1947



ZONING

All types of civil subdivisions in Pennsylvania, including cities, counties, boroughs and townships of the first and second class are permitted to enact zoning ordinances. To avail themselves of this power, they must establish Zoning Commissions whose membership, except in the case of cities and counties, is limited to five persons.

These Zoning Commissions are empowered to recommend to the governing body of the subdivisions they represent regulations governing the location, use, and size of buildings, size of lot which may be occupied, the size of yards, courts and other open spaces, density and distribution of population, and the use of buildings or land for trade, industry, residence, recreation, agriculture or other purposes.

They may recommend a division of the territory into districts and within such districts establish regulations as to the erection, alteration and use of buildings, or the use of land.

Such recommendations must be reasonable, must be in accordance with an over-all plan for local development and shall be in force only when adopted by the governing body of the subdivision.

Public hearings must be held before any zoning regulations or map can be adopted. As to counties, it is also required that any proposed zoning ordinance be submitted to the State Planning Board for advice and recommendations.

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Amendments or changes of zoning regulations may be adopted from time to time, but if 20 per cent or more of those whose property is directly affected protest such changes, they can be authorized only by a three-quarter vote of all the members of the Council of the city or borough, or of the Commissioners of a first class township, or by the vote of all the Supervisors of a second class township. County Commissioners must submit all amendments or changes in the zoning regulations both to the county Zoning Commission and to the Pennsylvania State Planning Board, but neither the State Planning Board nor the Zoning Commission may act on such suggestions in other than an advisory capacity.

In all types of civil subdivisions amendments or changes to zoning ordinances can be adopted only after public notice and public hearing.

After the adoption of a zoning ordinance it is required that there be appointed a Board of Appeal or Adjustment to which appeals may be taken in cases where literal enforcement of the Zoning Act would result in unnecessary hardship. Such a board has the power to grant variances and special exceptions (when expressly authorized by the ordinance) wherever, in its opinion, such grants would avoid unnecessary hardships and would not be contrary to the spirit or purpose of the original ordinance. Further provision for the protection of property owners is provided by the right of appeal to a court of record from any adverse decision of the Board of Adjustment.

When a county adopts a zoning ordinance, that ordinance replaces any zoning regulations previously adopted by second class townships within the county area. The county Zoning Commission may co-operate with the Zoning Commissions of other counties and with those of cities, boroughs, and first class townships with-

in or without the county, to coordinate the zoning of the county with the planning and zoning of other counties or municipalities.

By Act of the 1947 General Assembly the law regarding the adoption of ordinances in boroughs and second class townships was amended to permit a zoning ordinance to be published in the form of a brief summary as to its substance with a reference to the place or places where the complete text of the ordinance may be examined or obtained.

Counties	1937 P.L. 2129, Sec. 1-410 and Sec. 3-510
Cities, 1st class	1929 P.L. 1551
Cities, 2nd class	1919 P.L. 570 amended 1921 P.L. 503 and 1923 P.L. 122
Cities, 3rd class	1931 P.L. 932, Sec. 4110-4113
Boroughs	1923 P.L. 957 amended 1929 P.L. 529 1947 Act 568, Sec. 3301-3310
Townships, 1st class	1923 P.L. 957 and 1925 P.L. 368 1929 P.L. 529 1931 P.L. 1206, Art. XXXI
Townships, 2nd class	1937 P.L. 2624 amended 1943 P.L. 304 1947 Act 567, Sections 2001-2010
Regional	1943 P.L. 340 amended 1945 P.L. 206 and 1945 P.L. 1339

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SUBDIVISION CONTROL

In third-class cities, boroughs and counties all plans, plots, and replots of land laid out in building lots, and the streets, highways, and alleys intended to be dedicated to public use or for the use of purchasers or owners of lots within a subdivision must be submitted to the Planning Commission for approval before such plans or plots can be recorded. No unapproved plan can be lawfully received or recorded in any public office.

The jurisdiction of a City Planning Commission over subdivisions extends for three miles beyond the city limits, unless this area of control conflicts with the zoning authority of any other municipality, in which case it extends only to a point equally distant between the city limits and the limits of another municipality. Borough powers extend only to the borough limits.

The authority of a County Planning Commission to accept or refuse the approval of a subdivision plot or plan, and the dedication of streets or alleys does not extend to the area within any city or borough in the county and this authority exists only if a County Planning Commission has been created.

The direct power to control subdivisions by the Planning Commission of a first-class township conferred by the Act of 1931 was repealed in 1933, but restored to the Township Commissioners in 1947. The Township Commissioners are authorized to accept or reject, after public hearing, the dedication of any road, street, lane or alley or drainage facilities within the township, or to make alterations and specify changes in such

plans. The township has no responsibility in connection with any road, street, lane, alley or drainage facility except those constructed in strict accordance with plans approved by the Commissioners. The Commissioners are authorized to adopt land subdivision regulations covering all divisions into two or more lots. Penalties are provided for noncompliance. Such regulations may provide that plans for subdivisions shall be referred to the Township Planning Commission for its recommendations.

No road, street, lane, alley or drainage facility shall be opened, constructed or dedicated for public use except in accordance with approved plans, and neither the Commissioners nor any other public authorities shall place or operate sewers, drains, water pipes, or other facilities, or do work of any kind upon unauthorized and unapproved streets or alleys within the township.

Success in subdivision control depends largely, however, upon the recognition by public officials and by real estate operators that poorly planned developments are unnecessarily costly to a community, to the builders, and to the purchasers of properties.

They can add heavily to the tax load without compensating advantages. They can also cause a serious decline in the character of a residential community. Where these facts have been recognized there has been little difficulty in establishing a proper measure of control.

Cities	1931 P.L. 932, Sec. 4005
Boroughs	1927 P.L. 519—Sec. 1149 as amended
Counties	1937 P.L. 2124, Sec. 504 1947 Act 212, Sec. 504
Townships, 1st Class	1931 P.L. 1206, Sec. 2021-2022 1933 P.L. 1096 1947 Act 166, Article XXXa, Sec. 3061-3068

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AIRPORTS

Cities, towns, and boroughs are authorized to acquire land and to make expenditures for the purpose of establishing and maintaining airports or aviation landing fields, and may operate such fields jointly with the county in which they are situated. The land so acquired need not be within the civil subdivision, but must be within the same county.

By Acts of the 1947 General Assembly both first and second class townships are authorized to acquire land for airports or landing fields, to lease such lands, and to equip, operate and maintain municipal airports or to exercise such powers jointly with any other political subdivision or with a municipal authority.

All applications for Federal aid for airport development must be submitted for prior approval to the Pennsylvania Aeronautics Commission.

Counties may acquire land for aviation landing fields, or may appropriate for that purpose unredeemed land purchased at tax sales. They may act separately or jointly with other civil subdivisions in the operation and maintenance of such fields and their facilities, but they may not acquire land for airport purposes in other counties without the consent of the County Commissioners governing the area to be acquired. Both Cities and Counties may lease land for airport purposes to individuals or corporations, or to the Government of the United States.

Federal Aid Regulations	1947 Act 56
Counties	1941 P.L. 360 1947 Acts 173 and 306
Cities, 3rd Class	1931 P.L. 932, Art. XLII
Towns	1933 P.L. 1017
Boroughs	1931 P.L. 386, Sec. 2490 1933 P.L. 818, Sec. 2490
Townships, 1st Class	1947 Act 43
Townships, 2nd Class	1947 Act 44

AIRPORT ZONING

The Airport Zoning Act recognizes the fact that any structure, tree or use of land which obstructs the area required for landing or take-off of airplanes at public airports is a potential danger both to users of planes and to occupants of land in the vicinity of the airport. It classifies any such hazard as a public nuisance and empowers any civil subdivision in the State to expend public funds, if necessary, to prevent the creation or establishment of such hazards and to prescribe airport zoning regulations for the area within its territorial limits in which such structures or land uses would be dangerous.

Every subdivision having an existing or potential airport hazard within its territorial limits may adopt, administer and enforce airport zoning regulations by the establishment for that purpose of an Airport Zoning Commission. If the airport is located outside the territorial limits of the subdivision, it may join with the subdivision in which the airport is located in establishing a joint Airport Zoning Board whose membership shall be two representatives appointed by each subdivision and a chairman elected by the majority of the members so appointed. If such co-operation is refused, the subdivision controlling the airport may itself adopt and enforce zoning regulations for the airport hazard area.

Provisions for adopting an airport ordinance are similar to those under which a general Zoning Commission operates. An existing Planning or Zoning Commission may be appointed as an Airport Zoning Commission to carry out the provisions of this Act. The regulations of the Zoning Commission may require that a permit must be obtained before any new structure is erected or any new use made of land in an airport hazard area. No permit can be granted to allow the establishment or creation of a hazard, but an appeal is allowed to the

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Board of Adjustment or Appeals for any variance from the zoning regulations. No existing buildings or trees come under the provision of the Act. To permit trees to grow or structures to be increased in height within the airport hazard area, however, requires the allowance of a variance by the Board of Adjustment or Appeals. If the Board allows such an appeal, it may require the owner to permit the political subdivision to install and operate such markers or lights as may be necessary to indicate to flyers the presence of a hazard. Appeal to the courts from rulings of the Board of Adjustment is permitted as in the case of the general zoning laws. An existing Board of Appeals or Adjustment may serve as the Airport Zoning Board of Appeals.

Airport zoning regulations may be incorporated into the comprehensive zoning regulations of any political subdivision and may be administered and enforced in connection therewith. In the event of conflict between airport zoning regulations adopted under this Act by a political subdivision and other airport zoning regulations adopted by any other political subdivision in reference to the same area, or between airport zoning regulations and any other regulations governing the same area, the more stringent limitation or requirement shall govern or prevail.

Whenever it is desired to alter or terminate non-conforming uses or structures constituting an airport hazard and such termination cannot be obtained under the zoning laws, the political subdivision in which the airport or in which the non-conforming use occurs may acquire property by the power of eminent domain, but must, in addition to the damages for destruction or taking of property, also pay the cost of removal of any structure or any public utility which is required to be moved to a new location.

1945 P.L. 237

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PARKS AND RECREATION

Counties, cities, boroughs, townships and school districts may acquire or set apart lands or property for use as public parks, playgrounds, gymnasiums, public baths, swimming pools or indoor recreation centers. The authority to supervise recreational areas, facilities, or activities may be vested in any existing board or commission (such as a Planning Commission), or a Park or Recreation Board may be established. Such Boards when created shall be appointed by the mayor, burgess, commissioners or supervisors to serve for a term of five years. They elect their own officers and are authorized to employ personnel.

All types of civil division including school districts are authorized to pay from their treasury any expense incurred in the operation of public recreation facilities and activities, and may levy for such purposes a tax not to exceed two mills on the dollar of taxable property.

Cities are required to have a general plan of parks and other recreation centers.

Municipalities and school districts may co-operate in joint acquisition, maintenance and operation of parks, playgrounds, gymnasiums, swimming pools, etc.

Under the school laws, extension education (including instruction, recreational activities, or social services for out-of-school youth and for adults) has been made an integral part of the school system of the Commonwealth.

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Upon written application signed by fifteen or more residents above the age of sixteen, not in attendance at any public or private day school, the school directors of any school district are required to provide extension education for such applicants in any curricular course of study or activity; such extension education to be provided at any hour which does not conflict with the regular day-school activities, except on Sundays or legal Holidays. State reimbursement is provided for employes engaged in the instruction or direction of such activities on the same basis as for salaries in such districts in the regular day-schools.

By Act 141 of the General Assembly of 1947 Extension Education is specifically defined as including recreational and social services.

Cities, 3rd class	1931 P.L. 932, Sec. 3701-3721 1947 Act 148
Boroughs	1927 P.L. 519, Sec. 2701-2725, and amendments of 1933 P.L. 818 and 1943 P.L. 674
Townships, 1st class	1931 P.L. 1206, Sec. 3001-3013
Townships, 2nd class	1933 P.L. 103, Sec. 1901-1917
Counties, 2nd to 8th Class	1929 P.L. 1278, Sec. 650-656 as amended 1945 P.L. 368
School Districts	1919 P.L. 784 1921 P.L. 484 1925 P.L. 492 1927 P.L. 56 1937 P.L. 599 1945 P.L. 1112, Sec. 1250 1947 Act 141
Regional	1945 P.L. 206 P.L. 1339

PUBLIC FORESTS

Counties, third class cities, boroughs and townships may own public forests. Cities, boroughs and townships may acquire forest land lying within or without their limits by gift, purchase or lease, but must secure the approval of the Secretary of Forests and Waters for such action. Counties may develop for forest or recreational uses seated or unseated lands purchased by the County Commissioners at tax sales and unredeemed within two years after such purchase and must pay two cents per acre in lieu of taxes to the school district and township in which the land is situated.

Political subdivisions, other than counties, shall administer their forest land in accordance with the principles and practices of scientific forestry as designated by the Secretary of Forests and Waters, the main purpose of which shall be to ensure a continuing revenue from the sale of forest products. The revenues from public forests are paid into the treasury of the political subdivision, to be used for general public purposes.

The powers specified above are supplemented by the power to acquire land for parks or for watershed protection.

Counties	1933 **P.L. 35**
Cities, 3rd class	1931 P.L. 932,(c) Sec. 3830-3838
Boroughs	1927 P.L. 519, Sec. 2750-2757
Townships, 1st class	1931 P.L. 1206, Sec. 3040-3048
Townships, 2nd class	1933 P.L. 103, Sec. 1908-1917

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SHADE TREES

Third class cities, boroughs and townships of the first class may establish a Shade Tree Commission, which shall have exclusive custody and control of the shade trees within the municipality and is authorized to plant, remove, protect and maintain shade trees along the public streets. Whenever the Commission contemplates the removal, planting or replanting of any trees, notice of such activity and of the meeting at which such proposal will come under consideration shall be published in one or more newspapers.

The cost of such planting, replanting or removal shall be paid by the owner of the property in front of which the work is done; but, the cost of caring for trees after planting shall be paid by the municipality.

Cities, 3rd class .... 1931 P.L. 932, Sec. 3801-3810
Boroughs ..... 1927 P.L. 519, Sec. 2730-2746
Townships, 1st class 1931 P.L. 1206, Sec. 3020-3031

PARKING LOTS AND PARKING

Third class cities, boroughs and first class townships are authorized to acquire by lease, purchase or condemnation any lands, which in the judgment of the corporate authorities, may be necessary and desirable for the purpose of establishing and maintaining parking lots, and may regulate the use thereof. All civil divisions have the authority to regulate parking lots, to charge permit fees, and to require bonds from operators.

The Supervisors of Second Class Townships have the power to regulate parking so as to promote the convenience and protection of the public, provided such regulations shall not contravene the provisions of the "Vehicle Code."

General Regulatory Authority	1947 Act 21
Cities, 3rd class	1945 P.L. 582, Sec. 2403
Boroughs	1945 P.L. 1089, Sec. 2493
Townships, 1st class	1947 Act 96
Townships, 2nd class	1945 P.L. 271

CONTROL OF SIGNS

The posting of signs on the grounds or property of the State or of any civil subdivision is forbidden except for notices posted by law or on the order of a Court. It is also forbidden to post or paint any sign on any bridge, building or property within or without the limits of a highway without having obtained the written consent of the owner or tenant, except for notices authorized by law or on court order, or in respect to notices concerning or pertaining to the grounds on which the sign is placed.

1903 P.L. 20

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NUISANCE ABATEMENT

Third class cities, boroughs, and townships have authority to make regulations prohibiting and requiring the removal of nuisances within their boundaries. Penalties are provided for non-compliance with such regulations. "Nuisance" is defined in Clause XXVI of Sec. 1501 of the First Class Township Law as " . . . prejudicial to the public health or safety . . . "

The Supervisors of Townships of the second class have the power to prohibit accumulation of garbage and rubbish and the storage of abandoned or junked automobiles on private or public property, and to remove any nuisance or dangerous structure, if the owner after due notice fails to do so.

Cities, 3rd class	1931 P.L. 932, Sec. 2325-2326, also Sec. 4140-4143
Boroughs	1927 P.L. 519, Sec. 1202, VIII, IX
Townships, 1st class	1931 P.L. 1206, Sec. 1501 and 1606-07-08
Townships, 2nd class	1933 P.L. 103, Sec. 702 1947 Act 567

SMOKE REGULATION

Boroughs are given specific authority to regulate the emission of smoke from chimneys, smokestacks, and other sources except the smokestacks of locomotives.

Boroughs	1947 Act 568, Sec. 1202 LI

GARBAGE AND REFUSE DISPOSAL

Cities are authorized either to enter into contract for the collection and disposal of garbage, ashes, and other waste, or to purchase equipment and conduct a municipal collection and disposal service.

Boroughs and townships of the first class are also authorized to remove or enter into contract for the removal of garbage, ashes, and other waste and refuse matter.

Separately or jointly with one or more other municipalities they may purchase real property within or without their territorial limits to erect and maintain garbage or incinerating furnaces.

Townships of the second class are empowered to provide for the care and removal of ashes, garbage, and other refuse either with township employes and facilities or through an independent contractor.

Upon petition of the majority of adult taxable residents of any territory within the township which has been defined as a village, township supervisors may provide or contract for removal of ashes, garbage, or refuse and levy a per capita assessment sufficient to defray the cost of such removal.

Cities	1919 P.L. 358
	1931 P.L. 932
Boroughs	1927 P.L. 519
	1929 P.L. 1574
Townships, 1st class	1931 P.L. 1206
	1945 P.L. 452
	1947 Act 47
Townships, 2nd class	1929 P.L. 129
	1943 P.L. 276
	1947 Act 567

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A General Plan of Streets—Subdivision of Land

Cities, boroughs and first-class townships shall have a general plan of municipal streets, highways and alleys, including those which have been laid out but not opened. This plan shall be filed in a designated municipal office, preferably the Engineer's, and all later subdivisions of land must conform thereto. A street entered upon the official street plan may not be altered without the consent of the governing body. In cities, no map of streets may be entered in any public office of the county without the approval of council.

Cities, 3rd class .... 1931 P.L. 932, Sec. 2901, 2902, 2903
Boroughs ..... 1927 P.L. 519, Sec. 1660, 1661, 1662
Townships, 1st class 1931 P.L. 1206, Sec. 2001

(See also page 14 as to authority of Planning Commissions in cities or boroughs over subdivisions of land.)

Location of Streets—Building Lines

Cities, boroughs and first-class townships may, by ordinance, locate highways, streets and alleys. In doing this, they may include therein highways, streets, and alleys theretofore opened or used for highway purposes, may locate them with a greater width, or may revise the lines of such streets in accordance with new location, and place the same on the general street plan. Subdivisions of property thereafter made shall conform thereto. Taking of or entry upon property is not authorized by such location, as these actions must be taken in accordance with the law regulating such taking or entry; but, when a street has been located, no compensation may be awarded to any property owner for damage to buildings or other improvements erected or made

after such location is officially adopted. These powers, if fully utilized in accordance with a carefully prepared comprehensive plan, make possible enormous savings in the cost of later street widening. In second class townships, all "roads . . . shall be laid out, widened, changed, or vacated by the courts of quarter sessions."

Any type of civil subdivision may regulate building lines by provisions of a zoning ordinance governing setbacks and front yard depths.

Cities, 3rd class	1931 P.L. 932, Sec. 2904, 2905, 2906, 4115
Boroughs	1927 P.L.519, Sec. 1663, 1664, 1665
Townships, 1st class	1931 P.L. 1206, Sec. 1501, XXI, 2001
Townships, 2nd class	1933 P.L. 103, Sec. 1101

Acquisition of Unobstructed View at Intersections, etc.

Third class cities and townships have specific authority to acquire, by purchase or eminent domain, a free and unobstructed view at highway intersections, railroad crossings, and curves in highways, and so to prevent the use of lands for any purpose or in any manner which may interfere with or obstruct the vision of any person or persons traveling upon such highway. Unless specially provided for in condemnation proceedings such action shall not be construed to prevent the owner thereof from using such land for pasture or the growing of grass, oats, wheat, or other crops which will not obstruct the vision more than wheat. Such condemnations must be recorded with the Recorder of Deeds.

Cities, 3rd class	1931 P.L. 932, Sec. 2955
	1933 P.L. 927, Sec. 2955
Townships, 1st class	1931 P.L. 1206, Sec. 2040
Townships, 2nd class	1931 P.L. 675
	1933 P.L. 103, Sec. 1125
Boroughs,	
1st & 2nd class ...	1931 P.L. 675

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BUILDING AND PLUMBING REGULATIONS

Building Regulations

Third class cities, boroughs, and townships have power to regulate by ordinance the construction, alteration, repairs, occupation, maintenance, sanitation, lighting, ventilation, water supply, toilet facilities, drainage, use, and inspection of all buildings and appurtenant lands.

Cities, 3rd class	1931 P.L. 932, Sec. 4120-4121
Boroughs	1937 P.L. 313, as amended by 1939 P.L. 474
Townships, 1st class .	1931 P.L. 1206, Sec. 1502, XVIII, XIX 1947 Act 17
Townships, 2nd class	1937 P.L. 313 as amended by 1939 P.L. 474

Building Inspection

Third class cities, boroughs, and townships have power to inspect buildings for conformity with regulations governing construction, repair, sanitation, etc.

Cities, 3rd class	1931 P.L. 932, Sec. 4101-4102
Boroughs	1937 P.L. 313, as amended by 1939 P.L. 474
Townships, 1st class .	1931 P.L. 1206, Sec. 1502, XX
Townships, 2nd class	1937 P.L. 313 1939 P.L. 474

Plumbing Code and Inspection

The mayor of a third class city is required to appoint as a plumbing inspector, a practical plumber, the duty of whom shall be to supervise, superintend and inspect all plumbing, house and building drainage. This Act also establishes certain rules and minimum requirements for the construction of plumbing, house drainage, cess pools and building drainage.

Cities, 3rd class	1901 P.L. 493, as amended, 1909 P.L. 840, 1913 P.L. 476, 1937 P.L. 168 1939 P.L. 371 1947 Act 137

REAL ESTATE REGISTRY

Cities, boroughs, towns and first-class townships may by ordinance establish a real estate registry, an accurate and up-to-date record of the ownership of every lot or piece of real estate within their boundaries. The city or township engineer, and the borough secretary shall compile and maintain the registry. All owners of real estate, within one month after adoption of the ordinance, and every subsequent purchaser, within one month after purchasing real estate, shall report such ownership or transaction to the engineer or secretary, on blanks furnished for such purpose, showing location of such real estate, the owner, and previous transactions. Penalties are provided for non-compliance. Such records are admissible as evidence in court. Deeds of property sold at judicial sales shall be presented for registry by the Sheriff.

Cities, 3rd class ...	1931 P.L. 932, Sec. 1515-1519
Boroughs and Towns	1919 P.L. 1001 1927 P.L. 519, Sec. 3001-3006
Townships, 1st class	1931 P.L. 1206, Sec. 1310-1315 as amended, 1935 P.L. 716

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SEWERS

General Powers

Third class cities, boroughs, and townships may establish and construct sewer systems in the public highways, roads, streets, alleys, and lanes. The cost of such sewer and house connections may be assessed against the owners of abutting property. These political subdivisions may also construct the necessary sewage disposal works, and may acquire sewers owned privately by paying the actual value of the same at the time of taking, as determined by viewers, and reported to the governing body when agreement as to value cannot be reached. All civil subdivisions must secure a permit from the State Department of Health before installing a sewer system.

Cities may extend their sewer systems beyond their bounds into territory not served by a private company or municipal authority.

Public Health	1905 P.L. 260
Cities, 3rd class	1931 P.L. 932, as amended, Sec. 3201-3316 1947 Act 25
Boroughs	1927 P.L. 519, Sec. 2101-2173
Townships, 1st class	1931 P.L. 1206, as amended, Sec. 2401-2602
Townships, 2nd class	1933 P.L. 103, as amended, Sec. 1501-1541 1947 Act 357

Joint Sewer Boards

Third class cities, boroughs and townships joining or contemplating joining in construction of sewers, may by ordinance or resolution appoint a Joint Sewer Board composed of one representative from each of the political subdivisions joining. This Board shall act as the

general administrative agency in supervising the construction of the project and its subsequent maintenance and operation. Members may be compensated for attending—not to exceed $250 per year, plus actual expenses incurred, these to be paid by the respective political subdivisions which the members represent.

Cities, 3rd class	1935 P.L. 17 Third Class City Law of 1931, as amended by 1937 P.L. 915
Boroughs	1927 P.L. 519, Sec. 2120 to 2125, amended by 1937 P.L. 1735
Townships, 1st class .	1935 P.L. 22, Sec. 1, as amended 1937 P.L. 1734
Townships, 2nd class	1933 P.L. 103, Sec. 1540, amended by 1937 P.L. 1737 1947 Act 357

Non-Debt Revenue Bonds

Third class cities, boroughs and townships may issue non-debt revenue sewer bonds to finance building, alone or jointly, a sewer system or treatment works. These bonds are not to pledge the credit of nor be a lien against the city; but shall be a lien upon and payable solely from the annual rentals or charges for use of said sewer, sewer system, or treatment works. The bonds are salable, 1) to United States Government or own sinking fund; 2) to highest responsible bidder at an advertised public sale; 3) at private sale at no less than par value and accrued interest. In case of default on interest, holders of 25% of such bonds may appoint a trustee and receiver to take over operation and collect revenues.

Cities, 3rd class	1937 P.L. 578
Boroughs	1937 P.L. 582
Townships, 1st class .	1937 P.L. 574
Townships, 2nd class	1937 P.L. 571

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WATER SUPPLY AND WATER WORKS

General Powers

Third-class cities, boroughs and townships are authorized by law to provide an independent water supply for public and private use within the municipality. These municipalities may contract with a private water company to furnish water within the municipality, but in third-class cities, the privilege of furnishing water may be contracted away for a period not longer than ten years.

Third-class cities and boroughs may acquire and condemn land necessary for preventing contamination of water supply.

Cities, 3rd class	1905 P.L. 260 1931 P.L. 932, Art. XXXV, amended 1937 P.L. 57
Boroughs	1927 P.L. 519, Sec. 2401
Townships, 1st class .	1931 P.L. 1206, Sec. 2701, amended 1937, P.L. 756
Townships, 2nd class	1933 P.L. 103, Art. XVI 1947 Act 226

Water Works

Third-class cities, boroughs and townships may acquire, operate and maintain their own water works and water systems, may contract with a private water company or other municipality owning such works for delivery of water to the municipality and distribution of such water within the municipality.

Third-class city and borough councils may lease, on behalf of the city or borough, any water supply, water works and property from a private individual, partner-

ship, association, or corporation. All civil subdivisions must secure a permit from the Secretary of Health for the construction of a water system.

Public Health	1905 P.L. 260
Cities, 3rd class	1931 P.L. 932, Sec. 3501 1937 P.L. 57
Boroughs	1927 P.L. 519, Sec. 2401 to 2436
Townships, 1st class	1931 P.L. 1206, Sec. 2701 to 2705 as amended 1937 P.L. 756
Townships, 2nd class	1933 P.L. 103, Article XVI

Joint Acquisition and Construction of Water Supply and Water Works

Two or more boroughs, or a borough and a township may join in acquiring, or constructing and maintaining works for a supply of water, after plans for such works have been filed with and a permit issued by the Secretary of Health and the Water and Power Resources Board. A Commission of Water Works composed of citizens of each municipality may be appointed by the county Court of Common Pleas upon application, the borough, or townships having provided, by ordinance, or resolution for such joint ownership and maintenance.

Boroughs	1927 P.L. 519, Sec. 2435-2436
Townships, 1st class	1931 P.L. 1206, Sec. 2710-2712
Townships, 2nd class	1933 P.L. 103, Sec. 1606

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GAS AND ELECTRICITY

Cities and boroughs may erect and maintain the necessary buildings, machinery, and apparatus for manufacturing and distributing electricity or gas within the municipality. Cities may acquire property by condemnation on which to erect buildings for gas and electric light works. Boroughs may purchase the equipment of private companies furnishing electricity within the borough. Cities may contract away their power of furnishing electricity, but for periods not exceeding ten years.

Townships are empowered to establish lights along the highways after securing permission from State or county authorities if such highways are under State or county control. They may illuminate the streets of villages within the township on the petition of a majority of property owners along the highway, may enter into contract for street or highway illumination and assess property, except farm land, along highways on a front foot basis for such services.

Cities, 3rd class	1927 P.L. 1020 1931 P.L. 932, Secs. 3575, 3576 1933 P.L. 927, Sec. 2601 1937 P.L. 57, Sec. 3580
Boroughs	1927 P.L. 519, Secs. 2470-2479
Townships, 1st class	1931 P.L. 1206, Sec. 1502 1945 P.L. 172
Townships, 2nd class	1933 P.L. 103, Sec. 702 1947 Act 567

MUNICIPAL AUTHORITIES

Political subdivisions, (cities, towns, boroughs, townships, and counties) and groups of municipalities may establish Authorities for the purpose of acquiring, holding, constructing, improving, maintaining and operating, owning or leasing, either as lessee or lessor, buildings and other properties having a public purpose. This includes owning, leasing, or constructing and maintaining buildings for public uses and for revenue-producing purposes, marketing facilities, shopping centers, bridges, tunnels, streets, highways, traffic centers, parking spaces, airports, parks, recreational grounds and facilities, sewers, sewer systems, sewer treatment works, steam heating plants, incinerator plants, water works, water systems, swimming pools, playgrounds, lakes, dams, hospitals, motor buses for public use, and subways. Such facilities must not duplicate or compete with existing enterprises serving substantially the same purposes. Water rights can be acquired only after approval by the Water and Power Resources Board, and no property devoted to public use, nor any property of a public service company, nor any burial place or place of public worship may be acquired by eminent domain.

Authorities are bodies corporate and politic, having all corporate powers, and additional public powers such as right of eminent domain, etc. Existence is for fifty years; they may issue bonds of not more than a forty-year maturity; a municipality may transfer existing facilities or contracts to an Authority; contracts must be awarded to lowest responsible bidder if over $500; upon termination of an Authority, projects are

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conveyed to the municipality; the municipality may receive projects at any time by assuming the obligations of the Authority. Bondholders have right to appoint a trustee and bring suit in a Court of Common Pleas in event of default on bonds. Debts of an Authority are not debts of the municipality.

By Act of the General Assembly of 1947 public school buildings, flood control projects and works for the disposal of industrial waste are included within the scope of projects which may be undertaken by a municipal authority.

1945 P.L. 382
1947 Act 249

HOUSING AUTHORITIES

Counties, and cities of 30,000 or more population may establish Housing Authorities, if their governing bodies find that (1) unsanitary or unsafe dwelling accommodations exist in the city or county or (2) if there is a lack of sufficient, safe, and sanitary dwelling accommodations available to persons of low income. If such conditions impair the public health or morals or increase the hazard of fire or accident, the governing body may pass a resolution to that effect and cause its clerk to issue a certificate reciting the resolution. If the governing body fails to take such action, twenty-five citizens and taxpayers, residents in the county or city, may submit a petition to the Governor of the State, setting forth the need for such an Authority, whereupon the Governor may issue a certificate declaring that there is such a need.

This certificate, however, procured, must be filed with the Department of State and a duplicate with the State Board of Housing, and also with the governing body of the city or county, if the certificate is issued by the Governor. Upon issuance of such a certificate the County Commissioners of the county or the Mayor of the city must appoint five citizens as members of a Housing Authority. The method of choosing the personnel of this Authority differs, depending upon the classification of the county or city involved.

Such an Authority is recognized by the law as a public body, but is not an instrumentality of the city or county. It has power to investigate living and housing conditions, to determine the location of unsafe and unsanitary dwellings, or the areas in which there is a shortage of housing for persons of low income. It may study and make recommendations concerning the plan

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of any city or municipality within its field of operation in regard to the clearing, replanning or reconstruction of areas in which unsafe or unsanitary housing conditions exist, or in which there is a lack of dwelling accommodations for persons of lower income. It may cooperate with any public agency; it may construct and acquire property; it may act as an agent for the Federal Government; it may clear areas of unsanitary or unsafe housing, lease, rent or sell dwellings, and acquire property by eminent domain. Its projects are subject to the zoning, sanitary and building laws of the locality in which its project is located. It has the power to issue bonds, but its obligations are not obligations of the municipality or county within which it operates. Its property is exempt from all taxes and special assessments except school taxes, but in lieu of taxes it may agree to make payments for improvements, services and facilities for the benefit of a housing project and for persons dwelling thereon up to the estimated cost of such improvements and services.

Housing Authorities Law 1937 P.L. 955

URBAN REDEVELOPMENT AUTHORITIES

Urban Redevelopment Authorities have been authorized—one for each city and one for each county in the Commonwealth. These Authorities become operative whenever the governing body of any city or county declares by ordinance or resolution that there is need for such an Authority to function within its territorial limits. It must then file a copy of the resolution with the Department of State and duplicate copies with the State Board of Housing and the State Planning Board.

These Authorities have been created for the purpose of eliminating blighted areas or slums and for redeveloping such areas for residential, recreational, commercial, industrial, or other purposes. The Authorities created under the Urban Redevelopment Act are not instrumentalities of the cities or counties, but the five members of the Authority are appointed by the mayor or by the county commissioners. They are empowered to procure from the Planning Commission of the city or county information as to areas in need of redevelopment and as to recommendations for such redevelopment, or to develop such information where Planning Commissions have not yet been appointed. They may arrange or contract with any municipality located within their field of operation or with the State or Federal Government for the acquisition, planning or construction of facilities within a redevelopment area. They are empowered to acquire property by eminent domain, to issue subpoenas, to borrow money, to invest funds, and to contract for the redevelopment of an area.

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When the Planning Commission has certified any area as an area needing redevelopment and furnishes the Authority with an appropriate plan for such action, the Authority must review this plan, prepare a proposal for the redevelopment and submit that proposal to the Planning Commission for review. This plan must then be presented to the governing body which shall hold a public hearing on the proposal. After the approval of the governing body, The Authority may execute a redevelopment contract and take such action as may be necessary to carry it out under certain restrictions as to terms of contract. To finance its operations the Authority may issue bonds, after approval by the Department of Internal Affairs; it may borrow money or accept grants or other financial assistance from the State or Federal Government. Its books and records shall be open to inspection by the State Board of Housing. It must submit a copy of all its rules and regulations and of all its redevelopment proposals and contracts, and, at least once a year, a report of its activities for the preceding year to the State Planning Board and the State Board of Housing.

The constitutionality of this act was upheld by the Supreme Court of Pennsylvania in a decision rendered in July, 1947.

1945 P.L. 991

COUNTY SOIL CONSERVATION DISTRICTS

If the Commissioners of any County in the Commonwealth determine that conservation of soil resources and the control and prevention of soil erosion are matters of public concern in their county, they may by resolution declare the County to be a Soil Conservation District.

Such a District becomes a corporate public body acting as an agency of the Commonwealth.

It is governed by a Board of Directors appointed by the County Commissioners. This Board consists of five members including one member of the Board of County Commissioners. The other four members are chosen from a list of eight practical farmers nominated by County-wide farm organizations designated by the State Soil Conservation Commission to perform that function. These members receive traveling expenses, but serve without compensation.

The Directors have the power to conduct surveys as to soil erosion and conservation, and the improvement of land or the use of land within their district, to publish the results, and to publicize preventive measures, but all research programs are subject to the approval of the State Soil Conservation Commission, and, to avoid duplication of effort, must be conducted in co-operation with The Pennsylvania State College or some other authorized agency.

The Directors may employ necessary personnel, and carry out measures for improving the condition of the soil within their district, after obtaining the written consent of the owner and occupier of any tract of land on which they propose to perform such a service. To the extent of their available funds they may co-operate with and furnish financial or other aid, including fertilizer,

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seed and seedlings for erosion control or soil improvement to any occupier of lands in the district on such terms as they may prescribe.

They may acquire, improve, and dispose of land, make available equipment and materials and in co-operation with The Pennsylvania State College School of Agriculture, and with the approval of the State Soil Conservation Commission, develop and publish comprehensive plans for erosion control in their district.

They may co-operate with other districts and with State agencies.

Such districts may be terminated after five years by action of the Board of County Commissioners.

The County Commissioners are authorized to appropriate money to County Soil Conservation Districts. The State Soil Conservation Commission is authorized to provide assistance to and to coordinate the programs of the several districts, and to apportion among the districts any funds or other assistance allocated from State or Federal sources.

1945 P.L. 547

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SELECTED PUBLICATIONS OF THE PENNSYLVANIA STATE PLANNING BOARD

Publication No.

*1—Preliminary Report. 682 pages, 152 charts, December, 1934.

*10—Drainage Basin Study. 3 vols., 611 pages, 1937.

11—Planning and Zoning Powers and Procedures in Pennsylvania, 1938. Vol. 1. (Townships of the Second Class, Counties, Regions.)

12—Planning and Zoning Powers and Procedures in Pennsylvania, 1938. Vol. 2. (Cities, Boroughs, First Class Townships.)

*13—The Pennsylvania Zoning Primer. 1940.

14—Industrial Utility of Water. Part I. Temperatures and Chemical Content at Low Flow. June, 1945.

15—Recent Industrial Trends and New Employment Opportunities in Pennsylvania, 1944.

16—Retail Trade in Pennsylvania, 1946.

17—Chemical Character of Surface Water, August, 1947.

These publications may be seen in representative public libraries. A limited number of those listed are available for distribution until the present supply is exhausted. Those marked with an asterisk are now out of print but may be seen in representative public libraries.

Issues of **Pennsylvania Planning** are also available. The following are typical of subjects dealt with in this publication:

Local Tax Rates, May-June, 1940.

Community Self-Appraisal (Revised Edition), April, 1942.

Comparative County Data, May, 1942.

Planning and Zoning Progress in Pennsylvania, July, 1942.

Population, October, 1942.

Handicrafts in Post-War Planning, May, 1943.

Plastics, July, 1943.

Air Photographs, February, 1944.

Light Metals and Stainless Steel, August, 1944.

Topographic Mapping Needs, February, 1945. (For limited technical distribution.)

Community Action for Local Self Development, July, 1945.

Conservation, August, 1945.

Forest Resources, November, 1946.

Soil Conservation, September, 1947.

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DOCUMENTS SECTION

PENNSYLVANIA
DEPARTMENT OF COMMERCE
STATE PLANNING BOARD

RECREATION MANUAL

VOLUME NUMBER 5

PLANNING & ZONING POWERS & PROCEDURES

HARRISBURG-1949

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Commonwealth of Pennsylvania
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On the Road to Pine Grove Furnace

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RECREATION MANUAL

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THE STATE PLANNING BOARD *wishes to thank all members of the Pennsylvania Recreation Society for their constructive suggestions and material contributions to this Recreation Manual, and for the loan of many of the photographs used to illustrate the variety of recreational programs available in the communities of the Commonwealth.*

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CONGESTION AND LEISURE, A PROBLEM OF CIVIC MORALE

This Recreation Manual is the fifth in a series of publications by the Pennsylvania State Planning Board on local powers conferred under the State statutes for planning, zoning, and community development in Pennsylvania. It has been made necessary by the great changes which have taken place in our social and industrial pattern over the past ten years.

The remarkable population growth of the Commonwealth since 1940, an increase of 8 percent, has been mainly concentrated in the State's urban communities, large and small. As in every other period of great industrial expansion the problems of urban areas have grown progressively more serious. The rising birth rate of the past few years makes it certain that these problems will grow rather than diminish over the next decade.

The lack of adequate housing, which the State's urban communities share with those of other highly industrialized states, has created acute problems for both children and older folk. The restlessness engendered by the spectacle of universal war, and the uncertainties which that war has generated have greatly weakened many of the forces on which our society depended for its fundamental stability.

Parallel with these congestions and uncertainties has been a steady decline in the hours of labor of our indus-

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trial workers. As a result, leisure-time has become available to more of our people than ever before, but possibilities for the wise use of leisure within the community have diminished rather than grown.

To millions of our people whose lives must be passed mainly in the streets of great cities, or even of small towns, the need for public recreation facilities and for public recreation programs has grown more and more urgent.

This guide does not offer a complete text on public recreation. It can attempt only to supply information as to the provisions of State law under which every type of community can organize a recreation program suited to its necessities and means, and to suggest ways for fulfilling the purpose of the laws.

Four hundred Pennsylvania cities, boroughs, and townships are operating today some type of recreational program. More than 2,000 of our communities have not yet accepted a responsibility for guiding their young people and their older citizens toward the healthful use of that leisure-time which is made possible by modern conditions of life. It is largely to these latter communities that this recreation guide has been addressed.

In the competition which all communities now face, it is those which provide the best opportunities for healthful living which will most enjoy social and industrial peace, maintain their property values, and retain the loyalty of the young people growing up in their midst.

Public investment in a new recreation program, or in improving the program now operating in any community will pay off in better physical and mental health, improved morale, and broader education and culture for men, women and children and, in a great measure, will curb juvenile delinquency, attract new industry, improve citizenship and afford personal happiness to all officials and citizens promoting this type of public activity.

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RECREATION MANUAL

THE LEGAL AUTHORITY FOR A LOCAL RECREATION PROGRAM

Recreational planning for the family, for industrial groups, or for the general public means the coordination of people, time, and opportunity. In planning to provide leisure-time opportunities for the public, it is evident that offhand or makeshift procedures will result in little permanent benefit. The field of public recreation is too large and the interests involved too complex to be successfully dealt with by anything less than systematic planning.

Under the laws of Pennsylvania any community may provide recreation facilities or services for its citizens through one of the procedures outlined below:

Recreation Programs Under the State Enabling Acts

1. Counties, cities, boroughs, townships, and school districts may acquire or set apart lands or property for use as public parks, playgrounds, gymnasiums, public baths, swimming pools or indoor recreation centers. The authority to supervise recreational areas, facilities, or activities may be vested in any existing board or commission (such as a planning commission), or a park or recreation board may be established. Such boards, when created, shall be appointed by the mayor, burgess, commissioners or supervisors to serve for a term of five years. They elect their own officers and are authorized to employ

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personnel within the limits of funds made available to them.

All types of civil divisions including school districts are authorized to pay from their treasury any expense incurred in the operation of public recreation facilities and activities, and may levy for such purposes a tax not to exceed two mills on the dollar of taxable property.

2. It is possible for a group of citizens of any community to incorporate as a non-profit agency to administer a public recreation service.

This quasi-public corporation may call upon the borough council or like authority to serve as a sponsor. As such, council may (a) pass an ordinance designating the corporation as its legal arm to administer public recreation, (b) levy a special recreation tax or appropriate funds to support the program.

3. School districts may join with any city, borough, township, or county, or combination thereof, in equipping, maintaining, and operating indoor and outdoor public recreation facilities and programs, and may appropriate money for this purpose. Legal powers may be found in Section 4905 of the School Laws.

The State Planning Board, Harrisburg, will be glad to furnish upon application a copy of A Digest of Pennsylvania Laws Pertaining to Public Recreation, which covers the specific powers granted to each civil division, including the school boards.

Recreation Programs Under Pennsylvania School Laws

Pennsylvania School Laws authorize Boards of School Directors to organize and maintain community recreation programs as an integral part of their local programs of free public school service. Any type of recreational or social service is authorized for out-of-school youth and adults at any time which does not conflict with regular

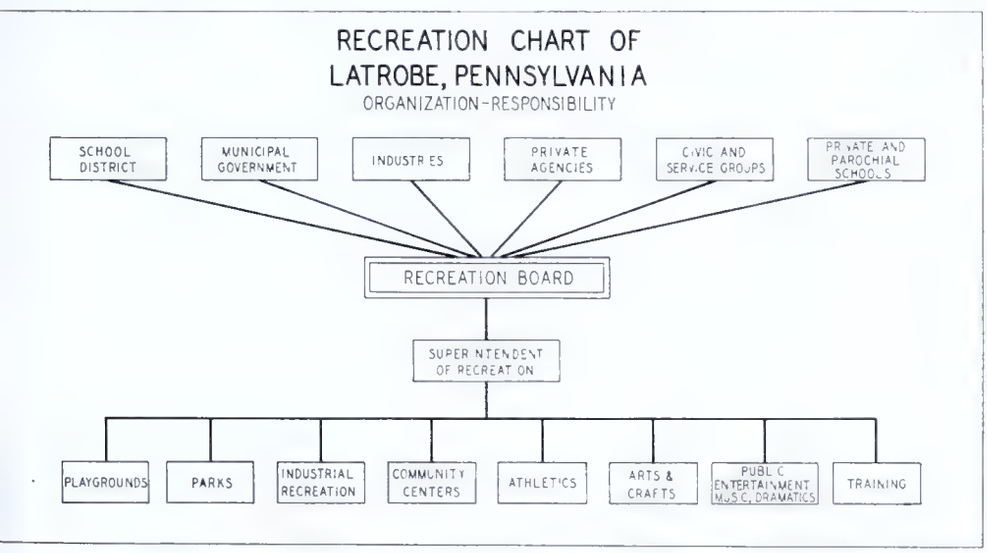
school activities. Such services are also authorized for day-school pupils and children, during their out-of-school hours, except the coaching and supervision of inter-scholastic athletic teams and games. (Section 4101, School Laws.)

All approved recreational activities maintained by a Board of School Directors are eligible for regular State aid. This State aid is available in the amount of the required minimum salary of recreation leaders of two dollars and fifty cents ($2.50) per hour multiplied by the standard reimbursement fraction of the School District concerned.

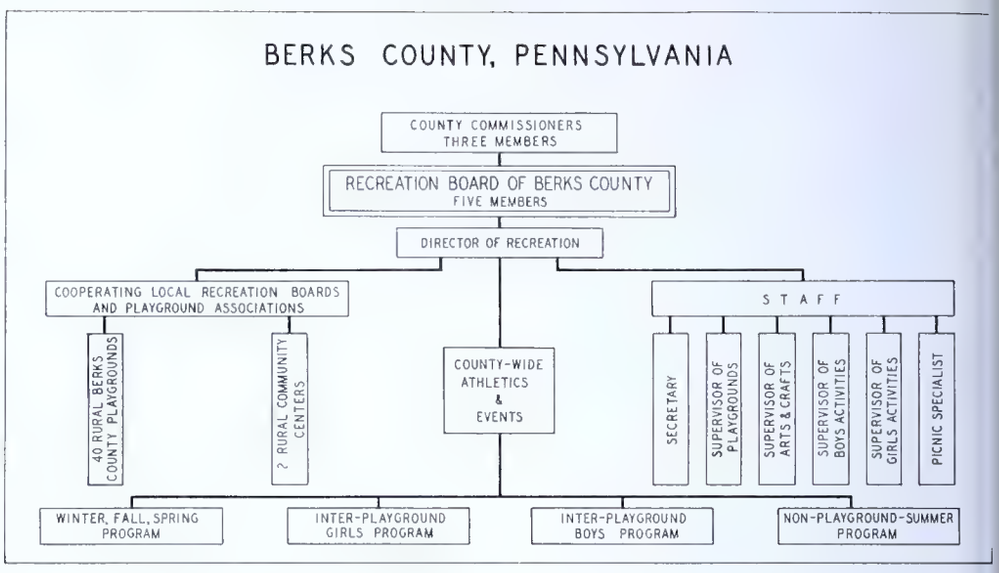
By Act 141 of the General Assembly of 1947 P. L. 324, Extension Education is specifically defined as including recreational and social services.

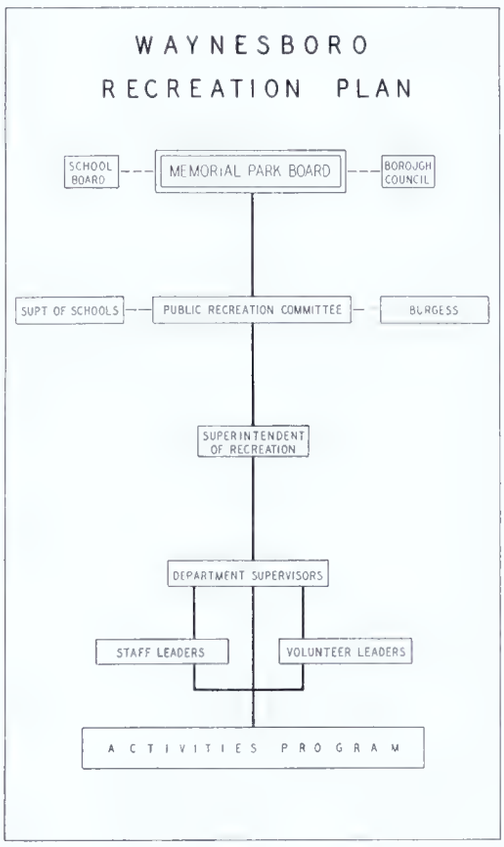
Bulletin No. 290, issued by the Division of Extension Education, Department of Public Instruction, Harrisburg, provides information covering extension recreation and social services available under public school auspices.

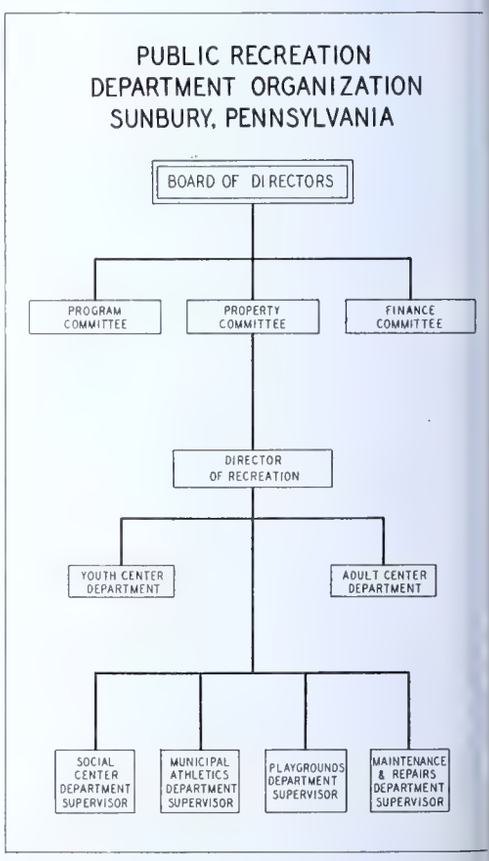
There is no set pattern for all communities. The selection of the administrative agency should be determined by the local situation.



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Typical Organization Charts

SUGGESTED PROCEDURES
FOR
PROMOTING AND ESTABLISHING A RECREATION PROGRAM

Before undertaking the development of a plan to provide adequate recreation services for any community, it would be well for all those interested to consider the following broad outline of ideals which express the agreement of most authorities in this field. While it is recognized that not all these items may be possible of immediate attainment in our smaller communities, it is felt that they represent the goal toward which every community's efforts should be directed. It might well be called a community recreation platform.

1. An all-inclusive recreational program operated on a twelve-month basis should be provided for all, regardless of age, race, creed, or color.

2. The program of leisure-time opportunities should be administered by the highest type of trained recreational leadership available.

3. The program should be planned to care for the needs and broad interests of all ages.

4. Public recreation services should be supported by public tax funds, while private and voluntary recreation services should be financed by voluntary contributions.

5. A community recreation plan should result in the fullest use of all resources and be integrated with long-range planning for all other community services.

6. Local planning commissions, recreation commissions, district school boards, and park boards should co-

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Skating in a Bellefonte Schoolyard

operate in the acquisition, development and use of recreational areas and facilities.

7. Recreation services should be definitely aimed toward enriching individual and community life, and are valuable only to the extent with which they are directed toward this goal.

Recreation programs should offer freedom of choice. Individuals of all ages enter into recreational activities because they desire to satisfy an urge from within. There should be no compulsion. Programs should be planned and formulated to meet the needs and interest of each neighborhood.



Romper Day at Allentown

AROUSING PUBLIC INTEREST

Public interest can be aroused by any individual or group aware of the recreation needs of the community and determined to improve the opportunities afforded the people.

Before undertaking the task of solving their local problems the individual or group should consult the following sources and obtain information which may guide them in achieving their purpose:

1. The recreation consultant services of the State Planning Board, Department of Commerce, Harrisburg, Pennsylvania.
2. The Division of Extension Education, Department of Public Instruction, Harrisburg, Pennsylvania.
3. The Pennsylvania State College Extension Service, State College, Pennsylvania.

They should visit communities that have established recreational programs and consult with the personnel in charge.

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The Clairton Community Band

The next important step is for the individual or group to make a preliminary survey of local conditions that will, no doubt, prove the necessity for better community recreation services. The result of this preliminary survey should be used to create interest in the minds of other influential citizens who will support the establishment of a sound leisure-time program for the community.



A Warm Day at Allegheny County's North Park

ASSEMBLING FOR ACTION

After preliminary individual conferences and study, and general publicity, it is important to bring together interested individuals from youth and adult groups, government officials, and representatives of appropriate community agencies and organizations. The first public assembly should receive an account of all findings and a statement of the purpose of the meeting, and should also receive a copy of a tentative plan of organization and action, such as:

THE FORMATION OF A PLANNING COMMITTEE

To be composed of representatives from all organizations interested in community affairs. This committee will serve as a fact-finding, surveying unit, headed by an energetic and capable chairman who can give freely of

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On an Easton Neighborhood Playfield

his time for community planning and organization. A small executive committee should be appointed to work with the chairman in assimilating facts and formulating recommendations to the policy-making organization. This planning committee should be charged with the responsibility of making a survey to determine:

1. Availability and accessibility of all existing areas and facilities which might be used for a community recreation program, such as
   a. Public parks, swimming pools or beaches, golf courses, tennis courts, vacant land areas, school buildings, and athletic fields.
   b. Private facilities similar to the above, including churches, clubs, and privately-owned vacant land or buildings that might be rented or made available for use in a public program.
2. Possibility of strengthening whatever program the community now has by coordinating private and commercial efforts into the public recreation program, or by



Handicrafts are Important in Many Programs

enriching the program with a greater variety of activities.

3. The need for additional funds for new facilities and equipment, in order to meet adequately present demands and future expansion.

4. The local talent and volunteer leadership available for various phases of the program.

5. Leisure-time habits of all age groups and a composite of their present interests and needs.

6. Need for a long-range community plan involving all phases of community living, such as:

   a. Housing conditions
   b. Health and sanitation
   c. Stabilization of land values
   d. Zoning problems
   e. Factors contributing to delinquency of both youth and adults

The planning committee should also survey all potential recreation areas within a fifty-mile radius of the community, such as county, State, or National parks or publicly-owned game lands, as well as private or commercial areas that might be used in the total program.

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At Trough Creek State Park

THE ESTABLISHMENT OF A LEGAL ADMINISTRATIVE BODY

All these recommendations and studies of the planning committee should be digested and presented to the public with one immediate end in view—to determine through which one of the legal means, discussed on pages 7 and 8 of this booklet, a recreation program can be carried out under the particular conditions met with in this community. Experience has proved that to assure the public of a permanent all-inclusive leisure-time program, public recreation should be administered by a legally established board or commission. It is, therefore, important that influential members of the community's governing body, including the school board, should be present at the meeting in which these matters are to be discussed, and, that they should be represented on the executive committee whose function it is to summarize the conclusions of the



Mixed Emotions at a Lancaster Field Day

planning committee, report them to the public, and take the lead in whatever action is to follow. It is obvious that a public recreation board or commission, appointed under the legal authority granted to every civil division, is the most satisfactory means for undertaking the various responsibilities of a recreation program. In the appendix to this booklet will be found a suggested form of ordinance through which a legal recreation commission may be established. The type will vary according to the size of the community and the desired method of meeting the local situation.

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THE FUNCTIONS OF A RECREATION BOARD OR COMMISSION

1. The interpretation of the recreation program to the public.
2. The development of social, political and financial support for the commission's activities.
3. The maintenance of high standards in recreation leadership and in the community's program.
4. The selection of an executive director, and definition of his powers and duties.
5. The appointment of all employes upon the recommendations of the executive.
6. The consideration and formulation of all major policies.
7. The approval of programs.
8. A continuing appraisal of the effectiveness of the director and staff in administering the program.
9. The approval of operating budgets and the securing of funds.
10. Close examination and authorization of all expenditures and an annual legal audit of all accounts.
11. Presentation to the public of an annual report on all activities and expenditures.
12. Consideration of all future needs of the community and of the recreation department, and the development of means for meeting those needs.



A Quiet Corner at the Crispus Attucks Center, Lancaster

PROGRAM PLANNING AND CONTENT

A well-balanced recreation program should offer freedom of choice in a wide variety of activities and interests during the leisure-time periods of all youth and adults. The program should be planned in advance, kept elastic, and given all the publicity possible.

An inclusive program, serving all ages and both sexes, regardless of race, creed, color, economic or social level, means more than just a summer playground program for children or an athletic program for the athletic-minded. It may not be possible to embark upon a full-scale program at once, but certainly there should be provisions for continuous growth in order to serve the needs and interests of the public.

The program should offer free instruction and guidance in most, if not all, of the following fields and activities:

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On a Reading Playfield

1. Arts and crafts
   a. Fine arts—charcoal, pencil, water colors and oils.
   b. Artcrafts—metal work, plastics, leather, felt gimp, woodwork, weaving, reed work and ceramics.
2. Dancing program
   a. Social, folk, square, clog and tap.
3. Dramatics program
   a. Plays, festivals, pageants, stagecraft, playwriting and production.
4. Music program
   a. Band, orchestra, choral groups, operettas and music appreciation.
5. Nature study and outings program
   a. Naturecraft, campcraft, woodcraft, camping, boating, hiking and biking.
6. Social activities program
   a. Parties, dances, games, picnics.



Sunbury's Future Symphony Orchestra

7. Sports program including all types of major and minor sports
   a. Major—Baseball, softball, basketball, football, touch football, tennis, boxing and track events. (Whenever possible arrange for competition in the above sports through league play, keeping in mind the age and weight groupings.)
   b. Minor — Archery, table tennis, marbles, quoits, horseshoes, badminton, volleyball, types of relays and other low organized games.
   c. Individual and Group Sports—Golf, swimming, diving, skating, coasting, tobogganing, skiing, hiking, biking and hobbies.
8. Special activity program
   a. Spring, summer and fall playgrounds with balanced inclusive programs of all high and low organized games.
   b. Clubs for all age groups in any field of activity.
   c. Field days, mass athletic meets, pageants, tournaments and holiday celebrations.

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Clairton's Municipal Pool

AREAS AND FACILITIES

Each community should survey its available areas and facilities for an all-inclusive, indoor-outdoor public recreation program. On the basis of the findings of the survey as to community interest and financial ability definite plans can be made to meet present and future needs. In remodeling existing areas and facilities, or in the planning of new ones, maintenance and operation costs may be kept at a minimum through careful planning.

Areas and facilities are the tools without which community recreation cannot succeed.

All public buildings, grounds, and equipment should be made available for public recreation insofar as this is possible without disrupting the established use of these areas and facilities. All privately-owned recreation areas and facilities should be correlated into the community program to avoid duplication of facilities and personnel.



On the Ice at Allegheny's South Park

Examples: Public school buildings, their grounds and certain equipment should be made available for the public recreation program after school hours, in the evenings, and in all vacation periods except Sundays and legal holidays. Public parks, libraries, auditoriums, community halls and church social rooms should all be used for the programs. Private clubs, Y.M.C.A. and Y.W.C.A. facilities should also be utilized, for no one agency is capable of doing a complete job alone. The pooling of areas, facilities, equipment, and leadership into one community program is the most economical and efficient method of operation.

In considering the total recreational area for any community it is well to keep in mind these pertinent facts:

1. Standards for outdoor facilities—

The number of outdoor and indoor facilities necessary to house a community program depends upon the population to be served.

a. Neighborhood Playlots — 2,000 to 10,000

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A Shady Corner on an Easton Field Day

square feet of play area are recommended for 40 to 60 children under 12 years of age. They should be located to serve a ¼ mile radius.

b. Neighborhood Playgrounds—three to seven acres of play area are recommended for every unit of 5,000 population. They should be located to serve a ¼ to ½ mile radius.

c. The Playfield—fifteen to twenty acres of play area are recommended for a community of 15,000 to 20,000 population. It should be located to serve a one mile radius.

d. The Community Recreation Park—thirty or more acres; 1 acre per 1,000 people minimum. A park should be planned so that 1/3 of the area can be used for active recreation, 1/3 for picnic purposes and 1/3 for other facilities such as a band shell, a swimming pool, or an indoor recreation center. It should be located to serve a one mile radius or more.



Easton Sand Sculptors at Work on a Masterpiece

2. All areas and facilities should be made safe for all ages, and particularly the age group which they are designed to serve.

3. In planning areas and facilities, obtain professional advice from a recreational consultant and a landscape architect.

4. For growth and expansion, surveys should be made, showing the trends of the population and the changing pattern of needs.

5. Careful planning and functional design have much to do with keeping maintenance and operational costs at a minimum.

The program should not be delayed because perfect areas, facilities and equipment are not available immediately. Intelligent, well-trained leadership will always take advantage of any available areas, facilities and equipment. To improvise and to remember that "necessity is the mother of invention" is the foundation of success for many new recreation programs.

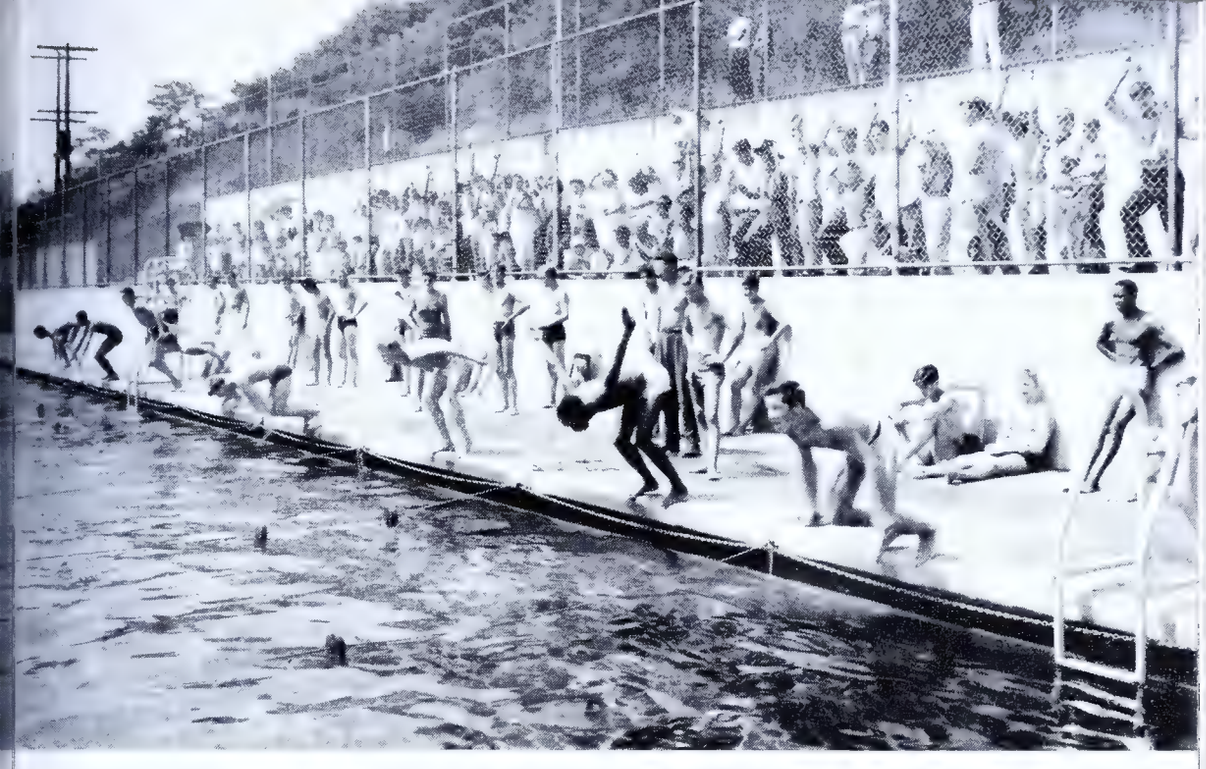
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Before and After

Wasteland in Latrobe becomes a Popular Athletic Field





Swimming is a Favorite Sport in Pittsburgh

ESSENTIAL RESPONSIBILITIES TO THE PUBLIC

The establishment and growth of a community recreation program depends upon a good public relations policy.

The local recreation director, his staff of workers, and the members of the managing board should develop an enthusiastic public relations program, using all available media for interpreting and promoting community leisure-time opportunities.

All local means of advertising, publicizing, and interpreting the program to the citizens should be explored and utilized. The following are suggested as some of the important lines of action:

1. Invite your public to assist in planning the program.
2. Hold frequent meetings or conferences where the public may witness one or more well conducted activities.
3. Make use of photographs, motion pictures, exhibits and demonstrations.

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Male Quartette, Lancaster

4. Maintain good relations, with local or nearby radio broadcasting stations which always welcome good program features and will announce special events.
5. Develop a good advisory council to assist with the community long-range plan.

Publicity should be aggressive, continuous, dignified, easily understandable, and designed to reach all the people.

TRAINED LEADERSHIP A "MUST"

The very best, well qualified, trained leadership is none too good, for the success of any recreational program depends more upon leadership than any other factor. In fact, a community may establish an adequate budget, possess the very best facilities, purchase the best equipment and yet fail miserably in achieving a good productive well-balanced program, because of poor leadership.

The personnel required to conduct a community recreation program should be comparable in professional



Not all Games are Noisy

training and personal qualifications with the personnel in a public school system, or a public health or welfare department. *Insist on having at least one thoroughly trained, full-time executive, who will be responsible to the legal managing board, and who is employed the year round.*

The managing board or commission charged with the selection of personnel should consider the following suggestions:

1. Establish a fair personnel policy that will insure all workers of security and advancement, and one that demands an efficient performance of duty.
2. Check on standards and qualifications for recreational personnel.
3. Establish a fair salary schedule.
4. Establish a rating system based on merit.
5. Establish responsibilities for each position or task.

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SOURCES OF TRAINED RECREATION LEADERS

1. Pennsylvania State College offers a four year undergraduate course with a major in recreation, and likewise, a graduate course leading to the doctors degree in recreation.

   Pennsylvania State College has an established placement bureau for recreation executives and leaders.

2. Temple University and the Universities of Pittsburgh and Pennsylvania offer courses in special phases of recreation.

3. The National Recreation Association, 315 Fourth Avenue, New York, New York, offers the following services.

   (a) A Trained Recreation Personnel Placement Bureau

   (b) A Leadership Training Institute service.

4. Your State Planning Board recreation consultant will gladly assist any community in securing a trained, experienced, recreation executive.

METHODS OF TRAINING LOCAL LEADERS

1. Professionally trained, recreation executive directors should hold training institutes at least twice each year.

2. Recreational executives, managing board members, and program personnel should attend yearly recreation workshop courses held at The Pennsylvania State College, or elsewhere in the Commonwealth.

3. The above mentioned personnel should attend district and State recreation conferences.

4. All recreation personnel should join the Pennsylvania Recreation Society and attend their quarterly meetings.



Family Camping at Cherry Spring State Park

WHERE A COMMUNITY IS PROVIDED WITH ADEQUATE RECREATION FACILITIES, SUCH AS PUBLIC OR PRIVATE PARKS, SCHOOL PLAYGROUNDS, ATHLETIC FIELDS, POOLS, GYMNASIUMS, MEETING ROOMS, AND SHOPS THAT CAN BE USED FOR THE PUBLIC PROGRAM, WHERE AN ADEQUATE BUDGET IS EARMARKED FOR PUBLIC RECREATION, AND WHERE THE LEADERSHIP IS SELECTED ON MERIT, THE RECREATION PROGRAM WILL BE SUCCESSFUL.

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APPENDIX A

FINANCING PUBLIC RECREATION

Budget

Annual funds specifically earmarked for recreation may be secured by:

1. Appropriation. The most common method of securing funds for a community recreation program for playgrounds, parks, etc. is by an appropriation from the city council, borough council, county commissioners, township, or school district treasury. This appropriation is earmarked for specific recreational purposes. Over 50 per cent of the communities having a recreation board secured funds through appropriations.
2. Tax Levy. A special tax, not to exceed two mills on the dollar of the taxable property in the political subdivision, may be levied for this purpose, under the State Enabling Act.
3. Extension Education Funds. Through Extension Education it is possible to channel State monies through the school districts to assist a community recreation program. This money may be used only for leadership and is subject to the regulations of the State Extension Education Act of 1925. This act may be found in Article 41 of the School Laws of Pennsylvania. The Extension Education Act was amended to specifically include recreational or social services as part of extension education by Act 141 of the Session of 1947 (P. L. 324).
4. Community Chest. In many communities money is appropriated from the community chest for public recreation purposes.
5. Private Gifts or Endowments. The growing appreciation of public recreation as a necessary public service and as a sound investment has attracted the attention of many private citizens and local business concerns. There are very few communities now maintaining a public recreation service that have not received private gifts of money, facilities, or equipment.

An established appropriation from the governing bodies of the borough, city, township, county, or school district is preferable as recreation then becomes part of the annual budget, and funds for its maintenance may be counted upon from year to year.

Recommendations

All Pennsylvania communities establishing new recreation departments or enlarging their present services should investigate and consider the following recommendations:

1. Call upon your local school district to share in sponsoring the public recreation program so that your leadership budget might be supplemented by State Extension Education reimbursement. This State aid for leadership must be administered by your local school district.

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2. Public recreation departments should maintain two budgets—
   a. Operation and maintenance
   b. Leadership only—
      1a. Professional or certified personnel for whom you may receive State aid.
      1b. Non-professional personnel not qualified for certification.

According to National survey averages, the leadership cost should represent 65 per cent of the total budget.

All funds received by the recreation department from tax levies, appropriations, donations, or other sources should be placed in a continuing fund, earmarked for public recreation. Under the terms of the State Enabling Act, no part of this fund shall revert to the general fund of the school district, borough, township, or county.

Public recreation, like education, public health, sanitation, safety, police protection, streets, and parks, should be considered a public service worthy of a proportionate share of the public tax monies.

APPENDIX B

RECREATION POSITIONS DEFINED WITH RECOMMENDED STANDARDS

Executive Director or Superintendent

Chief executive officer in charge of a recreation agency and its personnel, and responsible for promoting recreation service for all people of the community. He works with the board and its committees in the formulation of policies, procedures, and programs.

1. Duties. To carry out the policies and procedures established by the board. His duties may be classified as follows: administration, planning and research, publicity and general public relations, supervision of staff, program, finance, areas, facilities, records and reports. In the small community he may be required to perform a variety of duties not listed above.

2. Education and special qualifications. College graduation with majors in education, recreation, or related fields. Study on the graduate level is highly desirable and is especially valuable if taken after a period of practical experience in the recreation field. The Executive Director should possess a high sense of responsibility, a strong personality, good health, initiative, a broad cultural background, and a good sense of humor. He should also be a capable administrator and disciplinarian.

3. Experience. At least three years successful experience in public recreation, including supervision of program, finance, and public relations. The minimum amount of recreation executive experience varies with the size of the city.

Supervisors of Departments, Districts, or Areas

In charge of recreation services, programs and leadership in a definite department, district or area.

Examples: Supervisor of playgrounds, athletic fields, community centers, social centers, etc.

1. Duties. To be responsible for planning, organizing, coordinating and supervising the program in a particular field or area; to prepare work and time schedules, assign personnel and assure proper and safe use of area's facilities and equipment; to secure full effectiveness of all workers; to cooperate with individuals and groups in the neighborhood so that programs will satisfy and produce results; and to supervise the keeping of all records and reports for the department, district, or area. Supervisor may be called upon to perform all types of duties necessary to carry out the program.

2. Education and special qualifications. In general the same as for the chief executive. Weight should be given to courses in child and adult education, sociology, psychology, community planning, organization, and management. A supervisor should possess a fair knowledge of the philosophy of recreation, and of human needs, capacities, and interests in relation to recreation. He should have or acquire the same special qualifications as those of the executive, including the ability to organize and conduct programs, train and inspire personnel, plan, equip and maintain play areas and facilities. He should be competent to lead and instruct in at least three of these fields—arts, crafts, dance, drama, music, athletics, nature study and camping.

3. Experience. Two years previous experience as a special supervisor; as a playground, playfield, or recreation center director; or in some other recreation position involving executive or supervisory responsibilities.

Supervisors of Special Activities

In charge of one or more special phases of program development. They are primarily staff workers responsible to the chief executive or general supervisor.

Examples: Supervisors of art, crafts, drama, music and social activities.

1. Duties. To plan, initiate, organize, and supervise the program in a particular field; to study and determine community interests and needs in that field; to conduct training institutes for training specialists in the field; to prepare budget estimates for a program and submit reports of activities as requested by the chief executive. In small communities a supervisor of special activities may be called upon to perform all types of duties from sweeping the snack-bar floor to directing a play or concert.

2. Education and special qualifications. Equivalent to graduation from college, with major or special study in the field or fields in which he is to serve. He should possess a thorough knowledge of the rules, equipment, and facilities for his par-

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ticular phase of the program. He should be familiar with the various forms of recreation appropriate to his particular fields so everyone may derive enjoyment through participation in the activity. He should also have the ability to interpret his phase of the program to his co-workers, so they may become competent to act as instructors, promoters, and directors.

3. Experience. Previous experience in a public recreation system and as an organizer and teacher in special fields. A participant in a number of recreational activities is very desirable.

Recreation Director

In charge of administering the facilities, staff, and program of a single recreation center, such as playground, playfield, indoor centers, or camp. A recreation director is responsible to the chief executive or the supervisor in charge of his particular department.

Examples: Playground director, community center director, or camp director.

1. Duties. To have full charge of the operation, maintenance, and program of any particular center or area in the public recreation system, including personnel, facilities, equipment, and public relations; to plan and administer an attractive all-inclusive program suitable to the needs and interests of the people in the neighborhood and the public in general; to assure the proper maintenance of the center and to see that all structures, areas, and equipment are always in safe condition; to prepare budget estimates, maintain and submit financial, time, service, and program attendance reports; to follow the general policies adopted by the board in developing neighborhood relations and to cooperate with all groups and agencies; to teach, direct, or supervise all phases of the program in the center, and develop good working conditions and relations with both the paid and volunteer workers. Many small communities will call upon the recreation director to assume all of these various responsibilities, and therefore, he must be a utility man with special qualifications.

2. Education and special qualifications. College education or its equivalent. Courses in recreation theory and practice, adult education, educational methods, and in such activities as athletics, art, crafts, dramatics, music, nature study and club organization work should be included in his preparation. A director should possess a practical knowledge of the organization of leagues, tournaments, exhibits, field days and entertainments. He should have some measure of skill in all types of recreational activities. He should be experienced in selecting and training both paid and volunteer leaders for the program. A good sense of humor, social balance, plenty of initiative, and excellent health are certainly desirable.

3. Experience. At least two years as an assistant playground or center director, recreation leader, teacher, or worker in related fields, at least one year of which shall have included the operation of a program in an indoor recreation center.

Recreation Leader and Instructor

Personnel who, under general supervision of a director, lead, instruct, and coach a variety of activities, as games and sports of all types, handicrafts, dramatics, dancing, music, social events, and phases of camping.

1. Duties. To assist the director in all ways with the program; to teach skills and conduct organized games; to lead or instruct dancing, art, crafts, dramatics, nature study, and camping; to organize and lead club activities, social activities, and serve in all community-wide events; to care for equipment, supplies, and facilities; to demonstrate safety and first-aid, and assist in training junior leaders for the program; to perform all duties required by the director, supervisor, or chief executive.

2. Education and special qualifications. High school graduation, or its equivalent. Attendance at all pre-season institutes should be required. Capacity for organizing and working with youth and adults is essential.

3. Experience. Experience as a participant in recreation activities. Successful leadership experience in recreation or some allied field is desirable. Boy scout, girl scout, church work and summer camp experience is very valuable.

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APPENDIX C

SALARY RECOMMENDATIONS FOR PROFESSIONAL RECREATION LEADERS

Population	*Yearly Basis (Full Time)*				*Hourly Basis (Part Time)*
	Under 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
	(Min.)	(Min.)	(Min.)	(Min.)	(Min.)
Superintendent or Executive Director	$3,600	$4,500	$5,500	$6,500	$2.50
Supervisor of Department	3,400	3,600	4,500	5,000	2.00
Supervisor of Special Activity	3,400	3,400	4,000	4,500	1.75
Recreation Director	3,000	3,300	3,600	4,000	1.25
Recreation Leader	2,400	3,000	3,300	3,600	1.00

All local managing boards or commissions should keep three factors in mind when establishing recreation salary schedules:

1. Recreation is education at its best, and, a financial investment. *Good Leadership will pay good dividends.*
2. Short-sighted economy in salary schedules, resulting in employment of unskilled supervisory personnel, can negative all of the good work done by the board in developing fine facilities and programs.
3. Part-time or per session hourly rates for specialists should be higher than hourly rates for full-time work.

Inadequate compensation has no place in the recreation profession.

The above salary recommendations are a composite average taken from statistical surveys in many states across the nation. Where a community budget is inadequate to meet the above recommendations the local public school salary schedule may be used as a fair basis.

APPENDIX D

AN ORDINANCE
TO CREATE A RECREATION BOARD (or COMMISSION) FOR THE (CITY, BOROUGH, TOWNSHIP, COUNTY) OF .....

WHEREAS, the Recreation Enabling Legislation, enacted by the General Assembly of the Commonwealth of Pennsylvania, provides that

a. Every civil subdivision of the Commonwealth shall have a general plan of its parks and playgrounds;
b. Every civil subdivision may acquire lands, property, and buildings for the purpose of establishing and maintaining public parks, parkways, playgrounds, playfields, gymnasiums, public baths, swimming pools, or indoor recreation centers;
c. Every civil subdivision may provide for supervising, equipping, and maintaining public recreation areas and facilities through any existing body or through a recreation board;
d. All civil subdivisions may levy and collect such special taxes (not to exceed 2 mills) as they may deem necessary to finance the operation and maintenance of their recreation system, and they may make direct appropriations for same;
e. Any city, borough, township, county, or school district may perform the above public service jointly with any combination of civil subdivisions; and

WHEREAS, it is the considered judgment of the (governing body or bodies of the civil subdivision or divisions) ..... that adequate public recreation programs and facilities for the (civil subdivision) of ..... can best be advanced by placing the recreation system under the supervision and direction of a legally constituted recreation board or commission authorized by the Recreation Enabling Legislation of Pennsylvania; therefore, be it

Resolved, By the (city, borough, township, county, school district) .....

Section 1. That there is hereby created a recreation board known as the "..... of ....."

Section 2. That the board shall be composed of five members, to be appointed by the ..... (mayor, council, county, or township commissioners, or township supervisors), with the power to provide, conduct, and maintain public recreation areas, facilities, and centers subject to all the responsibilities of the Recreation Enabling Legislation. The board members shall serve for terms of five years, and until their successors are appointed, except that the members first appointed shall be so appointed that the term of

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one member shall expire annually thereafter. Vacancies shall be filled in the same manner as original appointments and for the unexpired term. Members shall serve without pay.

Section 3. That the recreation board shall appoint from its membership a chairman and such other officers as it may deem necessary for the orderly procedure of its business, and may adopt by-laws, rules, and regulations covering its procedure not inconsistent with the provisions of the State laws. The recreation board shall, from time to time, make rules governing the operation and conduct of the recreational facilities operated by the board. The board shall hold regular meetings at such times and places as it may designate.

Section 4. That the recreation board shall maintain, operate, and supervise the public parks, playfields, and all outdoor and indoor recreation areas and facilities owned or controlled by the .....

Section 5. That the recreation board may accept any grant, gift, bequest, or donation of services, equipment, real estate, or money from any individual or group, to be used as specified by the donor, or by the terms of acceptance. The recreation board shall have no authority to enter into any contract or incur any obligation binding upon the ..... , other than current obligations or contracts to be fully executed within the then current fiscal year, and all within the budget appropriations made by the governing body of .....

Section 6. That the recreation board shall have the power to appoint an executive director or superintendent of recreation, who possesses the necessary qualifications and who has demonstrated by actual work his ability to organize and direct a community recreation system, and such other personnel as may be deemed necessary and are recommended by the executive director.

Section 7. That funds appropriated by the governing body of the ....., and budgeted to the recreation board, shall be disbursed by the fiscal disbursing officer of the ....., upon vouchers issued by the recreation board and within the budget appropriations made. Funds received by the recreation board from sources other than budget appropriations shall be deposited by the ....., to the credit and for the use of the said board, and disbursed as the above budget funds are disbursed, except that funds received by gift, bequest, or otherwise shall be disbursed in accordance with the terms of such gift or bequest, or the terms of the acceptance thereof.

Section 8. That the recreation board shall make full and complete reports to the governing body at such times as may be designated or requested by the governing body. The

fiscal year of said recreation board shall conform to that of the .....

Section 9. That such powers as are now or may hereafter be provided by statute of the Commonwealth of Pennsylvania, or by ordinances of the ..... relating to the development and operation of recreation systems, public parks, and playgrounds, are hereby vested in the recreation board, to be exercised by it subject to any and all restrictions contained in such powers and ordinances.

Section 10. That all resolutions and ordinances of the ..... in conflict herewith are hereby repealed.

Section 11. That this resolution shall be in full force and effect ..... days after its passage.

Adopted this ..... day of 19

.....

.....

APPENDIX E

LEADERSHIP

1. The Pennsylvania State College, Irving Hall, State College, Pennsylvania. Recreation Personnel Placement Bureau.

PRELIMINARY COMMUNITY RECREATION SURVEYS

1. The State Planning Board, Department of Commerce, Harrisburg, Pennsylvania. Mr. Kenneth W. Abell, Recreation Consultant.
2. Pennsylvania State College Extension Service, School of Physical Education and Athletics, State College, Pennsylvania.
3. National Recreation Association, 315 Fourth Avenue, New York, New York.
4. Division of City Planning and Landscape Architecture, Department of Internal Affairs, Harrisburg, Pennsylvania.

PROFESSIONAL SURVEYS AND PLANS

Before a community takes final action in the development of their recreational areas and facilities, the services of a professional landscape architect and site planner should be obtained. We strongly recommend an architect experienced in the functional use of recreational areas and facilities.

FILMS

(Rental rates vary and should be checked with each distributor for accurate charges. To insure timely receipt of the films, plan film showings and book film in advance.)

Pennsylvania State College Audio Visual Aid Library, State College, Pennsylvania.

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American Legion National Headquarters, Indianapolis 6, Indiana.

American Red Cross, 40 East 49th Street, New York 17, New York.

Pennsylvania Department of Commerce, Tourist and Recreational Bureau, Harrisburg, Pennsylvania.

Association Films (YMCA), 347 Madison Avenue, New York 17, New York.

U. S. Children's Bureau, Social Security Administration, Federal Security Agency, Washington 25, D. C.

RECREATIONAL RESOURCES OF THE COMMONWEALTH

INFORMATION AND CONSULTANT SERVICES

Many departments of the State Government, including the Department of Labor and Industry, the Department of Military Affairs, the Pennsylvania State Police, the Department of Health, the Department of Welfare, the Board of Fish Commissioners, and the Pennsylvania Game Commission, are concerned in some of the problems which may be met with in organizing a community recreation program. In addition, the following agencies can supply specific information:

Department of Commerce

Apply to the Tourist and Recreational Bureau for maps, camping sites, camp facilities, tourist motels and cabins, summer and winter sports areas.

Apply to the State Planning Board for information on community development program, recreation planning, preliminary site planning and recreation consultant services.

Department of Internal Affairs

The Division of City Planning and Landscape Architecture may be called upon for consultation and assistance in local park and recreational site planning.

Department of Forests and Waters

The Bureau of Parks in the Department of Forests and Waters, Harrisburg, Pennsylvania, will furnish, upon request, detailed information pertaining to recreation facilities, equipment and program possibilities in all State Parks.

Department of Public Instruction

All problems pertaining to public recreation programs, instruction, certification and the use of public school facilities and equipment involve the local School District Board. Information as to the powers and duties of local school districts with respect to recreation may be secured from Division of Extension Education of the Department of Public Instruction, Harrisburg, Pennsylvania.

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SELECTED PUBLICATIONS OF THE PENNSYLVANIA STATE PLANNING BOARD

Publication No.

*1—Preliminary Report. 682 pages. 152 charts, December, 1934.

*10—Drainage Basin Study. 3 vols., 611 pages, 1937.

11—Planning and Zoning Powers and Procedures in Pennsylvania, 1938. Vol. 1. (Townships of the Second Class, Counties, Regions.)

12—Planning and Zoning Powers and Procedures in Pennsylvania, 1938. Vol. 2. (Cities, Boroughs, First Class Townships.)

15—Recent Industrial Trends and New Employment Opportunities in Pennsylvania.

16—Retail Trade in Pennsylvania, 1946.

17—Industrial Utility of Water in Pennsylvania. Chemical Character of Surface Water, 1944 to 1946. 1947.

18—The Pennsylvania Zoning Primer (Revised), 1948.

19—Local Powers for Community Development, 1948.

20—A Pennsylvania Recreation Manual, 1949.

These publications may be seen in representative public libraries. A limited number of those listed are available for distribution until the present supply is exhausted. Those marked with an asterisk are now out of print but may be seen in representative public libraries.

The following issues of **Pennsylvania Planning** are still available.

Local Tax Rates, May-June, 1940.

Community Self-Appraisal (Revised Edition), April, 1942.

Comparative County Data, May, 1942.

Planning and Zoning Progress in Pennsylvania, July, 1942.

Population, October, 1942.

Handicrafts in Post-War Planning, May, 1943.

Plastics, July, 1943.

Air Photographs, February, 1944.

Light Metals and Stainless Steel, August, 1944.

Topographic Mapping Needs, February, 1945. (For limited technical distribution.)

Community Action for Local Self Development, July, 1945.

Conservation, August, 1945.

Forest Resources, November, 1946.

Soil Conservation, September, 1947.

Minerals Conservation, December, 1948.

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PENNSYLVANIA
DEPARTMENT OF COMMERCE
STATE PLANNING BOARD

RECREATION MANUAL

VOLUME NUMBER 5

PLANNING & ZONING POWERS & PROCEDURES



HARRISBURG—1950

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REVISED EDITION

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On the Road to Pine Grove Furnace

A Pennsylvania Recreation Manual

Revised Edition

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THE STATE PLANNING BOARD *wishes to thank all members of the Pennsylvania Recreation Society for their constructive suggestions and material contributions to this Recreation Manual, and for the loan of many of the photographs used to illustrate the variety of recreational programs available in the communities of the Commonwealth.*

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CONGESTION AND LEISURE, A PROBLEM OF CIVIC MORALE

This Recreation Manual is the fifth in a series of publications by the Pennsylvania State Planning Board on local powers conferred under the State statutes for planning, zoning, and community development in Pennsylvania. It has been made necessary by the great changes which have taken place in our social and industrial pattern over the past ten years.

The remarkable population growth of the Commonwealth since 1940, an increase of 8 percent, has been mainly concentrated in the State's urban communities, large and small. As in every other period of great industrial expansion the problems of urban areas have grown progressively more serious. The rising birth rate of the past few years makes it certain that these problems will grow rather than diminish over the next decade.

The lack of adequate housing, which the State's urban communities share with those of other highly industrialized states, has created acute problems for both children and older folk. The restlessness engendered by the spectacle of universal war, and the uncertainties which that war has generated have greatly weakened many of the forces on which our society depended for its fundamental stability.

Parallel with these congestions and uncertainties has been a steady decline in the hours of labor of our industrial workers. As a result, leisure-time has become available to more of our people than ever before, but

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possibilities for the wise use of leisure within the community have diminished rather than grown.

To millions of our people whose lives must be passed mainly in the streets of great cities, or even of small towns, the need for public recreation facilities and for public recreation programs has grown more and more urgent.

This guide does not offer a complete text on public recreation. It can attempt only to supply information as to the provisions of State law under which every type of community can organize a recreation program suited to its necessities and means, and to suggest ways for fulfilling the purpose of the laws.

Seven hundred and twenty-five Pennsylvania cities, boroughs, and townships are operating today some type of recreational program. More than 1500 of our communities have not yet accepted a responsibility for guiding their young people and their older citizens toward the healthful use of that leisure-time which is made possible by modern conditions of life. It is largely to these latter communities that this recreation guide has been addressed.

In the competition which all communities now face, it is those which provide the best opportunities for healthful living which will most enjoy social and industrial peace, maintain their property values, and retain the loyalty of the young people growing up in their midst.

Public investment in a new recreation program, or in improving the program now operating in any community will pay off in better physical and mental health, improved morale, and broader education and culture for men, women and children and, in a great measure, will curb juvenile delinquency, attract new industry, improve citizenship and afford personal happiness to all officials and citizens promoting this type of public activity.

A Pennsylvania Recreation Manual

THE LEGAL AUTHORITY FOR A LOCAL RECREATION PROGRAM

Recreational planning for the family, for industrial groups, or for the general public means the coordination of people, time, and opportunity. In planning to provide leisure-time opportunities for the public, it is evident that offhand or makeshift procedures will result in little permanent benefit. The field of public recreation is too large and the interests involved too complex to be successfully dealt with by anything less than systematic planning.

Under the laws of Pennsylvania any community may provide recreation facilities or services for its citizens through one of the procedures outlined below:

Recreation Programs Under the State Enabling Acts

1. Counties, cities, boroughs, townships, and school districts may acquire or set apart lands or property for use as public parks, playgrounds, gymnasiums, public baths, swimming pools or indoor recreation centers. The authority to supervise recreational areas, facilities, or activities may be vested in any existing board or commission (such as a planning commission), or a park or recreation board may be established. Such boards, when created, shall be appointed by the mayor or burgess with the approval of council, or by commissioners or supervisors. Members serve for a term of five years. They elect their own officers and are authorized to employ personnel within the limits of funds made available to them.

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All types of civil divisions including school districts are authorized to pay from their treasury any expense incurred in the operation of public recreation facilities and activities, and may levy for such purposes a tax not to exceed two mills on the dollar of taxable property, except in the case of boroughs where no such limitation is imposed.

2. It is possible for a group of citizens of any community to incorporate as a non-profit agency to administer a public recreation service.

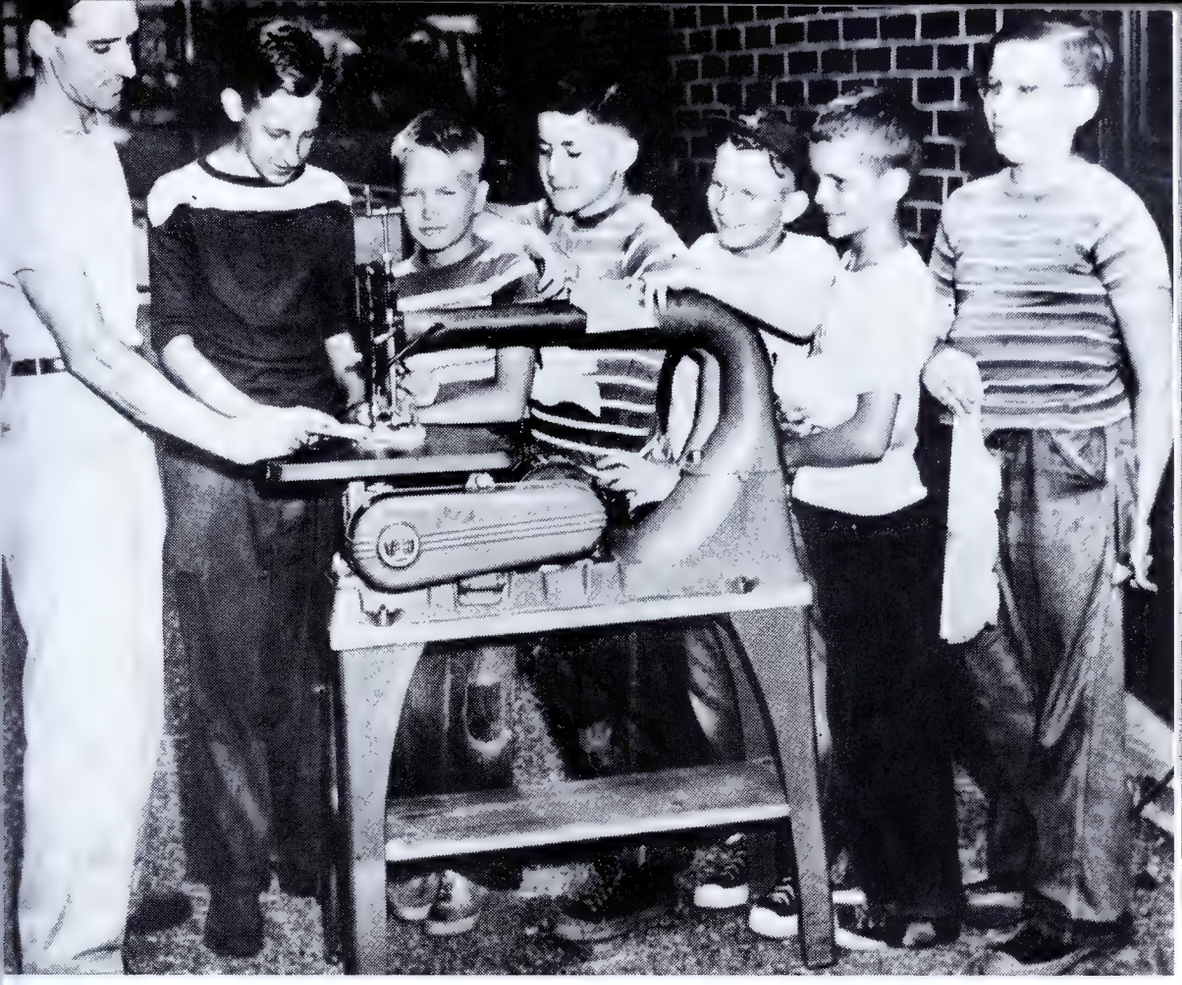
This quasi-public corporation may call upon the borough council or like authority to serve as a sponsor. As such, council may (a) pass an ordinance designating the corporation as its legal arm to administer public recreation, (b) levy a special recreation tax or appropriate funds to support the program.

3. School districts may join with any city, borough, township, or county, or combination thereof, in equipping, maintaining, and operating indoor and outdoor public recreation facilities and programs, and may appropriate money for this purpose. Legal powers may be found in the School Code, Act 14, 1949.

The State Planning Board, Harrisburg, will be glad to furnish, upon application, a copy of A Digest of Pennsylvania Laws Pertaining to Public Recreation, which covers the specific powers granted to each civil division, including the school boards.

Recreation Programs Under Pennsylvania School Laws

Pennsylvania School Laws authorize Boards of School Directors to organize and maintain community recreation programs as an integral part of their local programs of free public school service. Any type of recreational or social service is authorized for out-of-school youth and adults at any time which does not conflict with regular school activities. Such services are also authorized for day-school pupils and children, during their out-of-school hours, except the coaching and supervision of interscholastic athletic teams and games. (Section 1901, School Code.)



Guiding the Creative Instinct

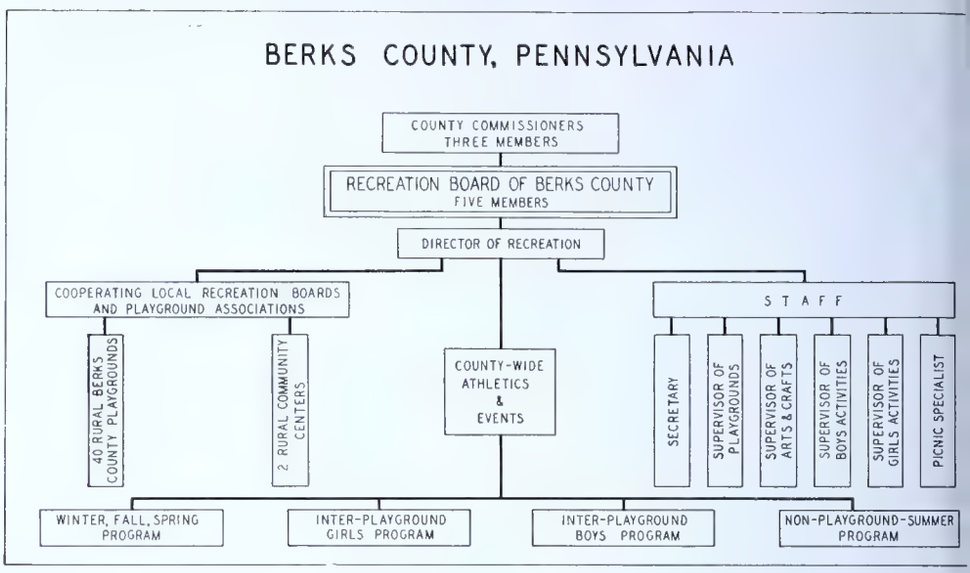
All approved recreational activities maintained by a Board of School Directors are eligible for regular State aid. This State aid is available in the amount of the required minimum salary of recreation leaders of two dollars and fifty cents ($2.50) per hour multiplied by the standard reimbursement fraction of the School District concerned.

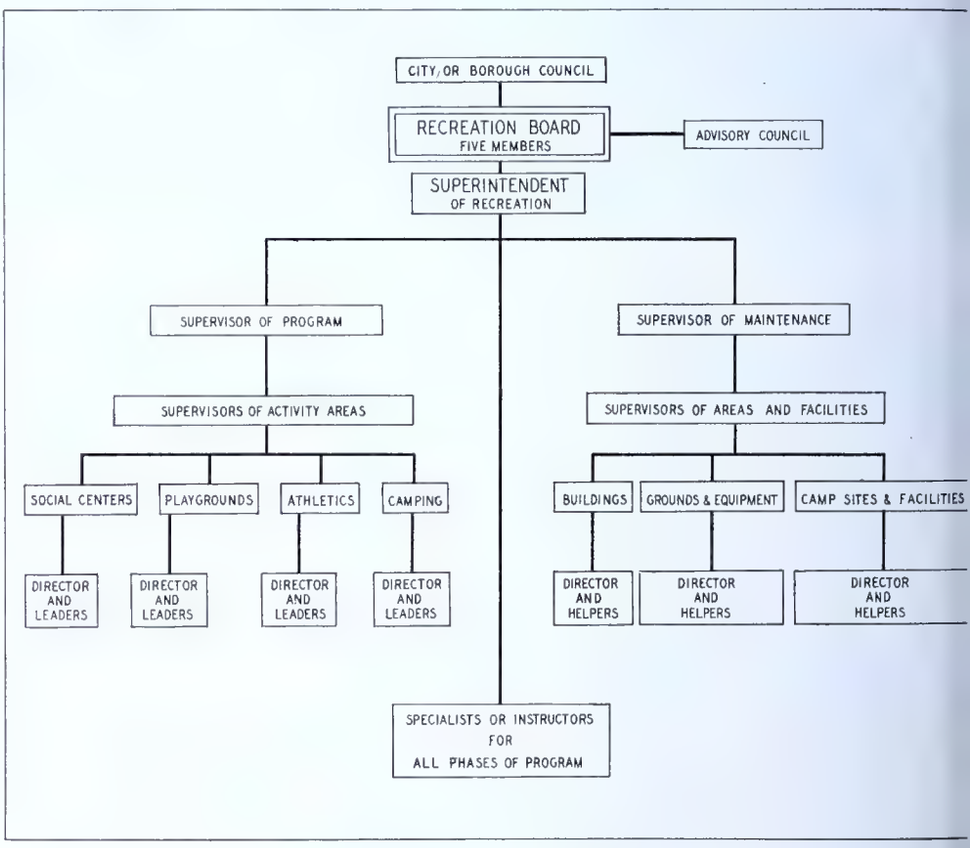
By Act 141 of the General Assembly of 1947 P. L. 324, Extension Education is specifically defined as including recreational and social services.

Bulletin No. 290, issued by the Division of Extension Education, Department of Public Instruction, Harrisburg, provides information covering extension recreation and social services available under public school auspices.

There is no set pattern for all communities. The selection of the administrative agency should be determined by the local situation.

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Typical Organization Plans

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THE IMPORTANCE OF COMMUNITY PLANNING

To satisfy the needs of a growing community, a recreational program must be based on a sound program for the community's development. Adequate housing, the most effective location of schools and other public institutions in relation to the pattern of the community's growth, the layout of streets and parking spaces which will make possible the safe and convenient flow of traffic into and out of the community's business and industrial areas, the protection of residential districts from the unnecessary intrusion of commercial uses, the location of parks and playgrounds at points where they will serve the needs of each neighborhood with maximum safety and convenience of the community's children and adults are all essential elements in a community plan in which recreation has an important but not an independent part.

The planning or development of recreation areas must be related to existing school facilities, to the density of population, to the occupational patterns and the direction of growth within a municipal area. Traffic along the highways is a vital consideration in the location of playing spaces, whether those spaces are small neighborhood playgrounds or community recreation areas which must sometimes anticipate large crowds of spectators. Thus, recreation planning, whether for facilities or programs, can rarely be successful unless based on an over-all view of a community's character and needs. In hundreds of Pennsylvania municipalities, large and small, an official planning commission has proved the agency best adapted to investigate and appraise a community's prospects and ideals. Such a commission acting as an advisory body to the municipal government and with the power to regulate

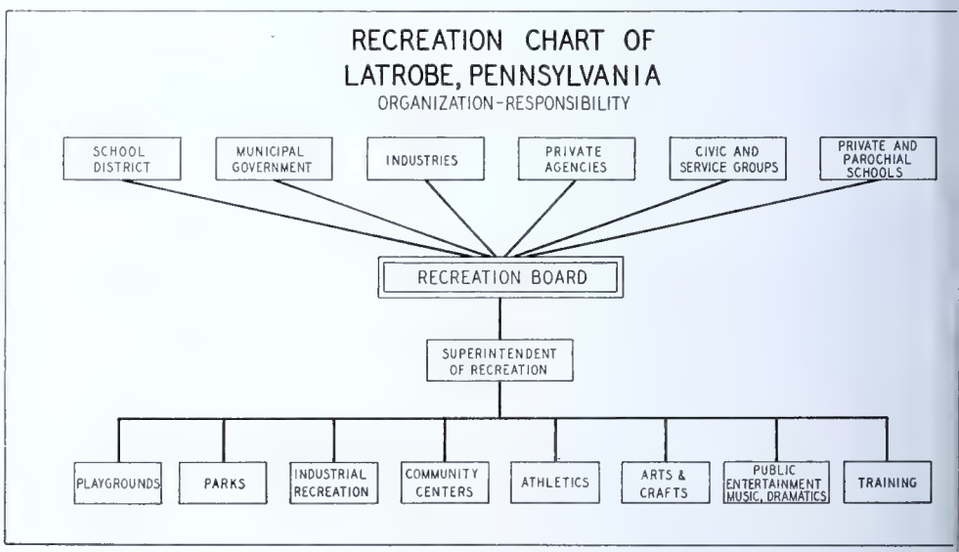
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subdivision layouts, can do much to improve the attractiveness of a community as a place for good living and prosperous work. The laws of Pennsylvania directly authorize the establishment of such planning commissions in all types of political subdivisions except second class townships. Even in those areas the zoning enabling laws enable citizens to control undesirable developments and direct their growth along desired lines. If a planning commission is active in your community then the important forward step has already been taken toward developing the basic plans so vital to a successful recreation program. If no planning commission is active the Recreation Board or Commission should establish a planning committee to coordinate the recreation program with the overall pattern of community growth.

Citizens interested in activating the creation of a community Planning Commission should write for copies of "Local Powers for Community Development" and "Planning and Zoning, Powers and Procedures" in the Commonwealth of Pennsylvania, Volumes 1 or 2, which are recent publications of the Board, and will be found listed on the inside back cover of this Manual.





Skating in a Bellefonte Schoolyard

SUGGESTED PROCEDURES

FOR

PROMOTING AND ESTABLISHING A RECREATION PROGRAM

Before undertaking the development of a plan to provide adequate recreation services for any community, it would be well for all those interested to consider the following broad outline of ideals which express the agreement of most authorities in this field. While it is recognized that not all these items may be possible of immediate attainment in our smaller communities, it is felt that they represent the goal toward which every community's efforts should be directed. It might well be called a community recreation platform.

1. An all-inclusive recreational program operated on a twelve-month basis should be provided for all, regardless of age, race, creed, or color.

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Romper Day at Allentown

2. The program of leisure-time opportunities should be administered by the highest type of trained recreational leadership available.

3. The program should be planned to care for the needs and broad interests of all ages.

4. Public recreation services should be supported by public tax funds, while private and voluntary recreation services should be financed by voluntary contributions.

5. A community recreation plan should result in the fullest use of all resources and be integrated with long-range planning for all other community services.

6. Local planning commissions, recreation commissions, district school boards, and park boards should cooperate in the acquisition, development and use of recreational areas and facilities.

7. Recreation services should be definitely aimed toward enriching individual and community life, and are valuable only to the extent to which they are directed toward this goal.



A Warm Day in Allegheny County's North Park

AROUSING PUBLIC INTEREST

Public interest can be aroused by any individual or group aware of the recreation needs of the community and determined to improve the opportunities afforded the people.

Before undertaking the task of solving their local problems the individual or group should consult the following sources and obtain information which may guide them in achieving their purpose:

1. The recreation consultant services of the State Planning Board, Department of Commerce, Harrisburg, Pennsylvania.
2. The Division of Extension Education, Department of Public Instruction, Harrisburg, Pennsylvania.
3. The Pennsylvania State College Extension Service, State College, Pennsylvania.

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An Off-Street Play Space in Easton

They should visit communities that have established recreation programs and consult with the personnel in charge.

The next important step is for the individual or group to make a preliminary survey of local conditions that will, no doubt, prove the necessity for better community recreation services. The result of this preliminary survey should be used to create interest in the minds of other influential citizens who will support the establishment of a sound leisure-time program for the community.

Recreation programs should offer freedom of choice. Individuals of all ages enter into recreational activities because they desire to satisfy an urge from within. There should be no compulsion. Programs should be planned and formulated to meet the needs and interest of each neighborhood. Adequate area and facilities for both indoor and outdoor activities must be provided. Trained professional leaders should be employed.

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ASSEMBLING FOR ACTION

After preliminary individual conferences and study, and general publicity, it is important to bring together interested individuals from youth and adult groups, government officials, and representatives of appropriate community agencies and organizations. The first public assembly should receive an account of all findings and a statement of the purpose of the meeting, and should also receive a copy of a tenative plan of organization and action, such as:

THE FORMATION OF A RECREATION PLANNING COMMITTEE

To be composed of representatives from all organizations interested in community affairs. This committee will serve as a fact-finding, surveying unit, headed by an energetic and capable chairman who can give freely of his time for community planning and organization. A small executive committee should be appointed to work with the chairman in assimilating facts and formulating recommendations to the policy-making organization. This planning committee should be charged with the responsibility of making a survey to determine:

1. Availability and accessibility of all existing areas and facilities which might be used for a community recreation program, such as:
   a. Public parks, swimming pools or beaches, golf courses, tennis courts, vacant land areas, school buildings, and athletic fields.
   b. Private facilities similar to the above, including churches, clubs, and privately-owned

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Archery Unites the Ages

vacant land or buildings that might be rented or made available for use in a public program.

2. Possibility of strengthening whatever program the community now has by coordinating private and commercial efforts into the public recreation program, or by enriching the program with a greater variety of activities.

3. The need for additional funds for new facilities and equipment, in order to meet adequately present demands and future expansion.

4. The local talent and volunteer leadership available for various phases of the program.

5. Leisure-time habits of all age groups and a composite of their present interests and needs.



A Junior Field Day

6. Need for a long-range community plan involving all phases of community living, such as:

   a. Housing conditions
   b. Health and sanitation
   c. Stabilization of land values
   d. Zoning problems
   e. Factors contributing to delinquency of both youth and adults

The planning committee should also survey all potential recreation areas within a fifty-mile radius of the community, such as county, State, or National parks or publicly-owned game lands, as well as private or commercial areas that might be used in the total program.

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Handicrafts are Important in Many Programs

THE ESTABLISHMENT OF A LEGAL ADMINISTRATIVE BODY

All these recommendations and studies of the planning committee should be digested and presented to the public with one immediate end in view—to determine through which one of the legal means, discussed on pages 7 and 8 of this booklet, a recreation program can be carried out under the particular conditions met with in your community. Experience has proved that to assure the public of a permanent all-inclusive leisure-time program, public recreation should be administered by a legally established board or commission. It is, therefore, important that influential members of the community's governing body, including the school board, should be present at the meeting in which these matters are to be discussed, and that they should be represented on the executive committee whose function it is to summarize the conclusions of the planning committee, report them to the public, and take



The Fine Arts Open Wider Horizons, State College

the lead in whatever action is to follow. It is obvious that a public recreation board or commission, appointed under the legal authority granted to every civil division, is the most satisfactory means for undertaking the various responsibilities of a recreation program. In an appendix to this booklet will be found a suggested form of ordinance through which a legal recreation commission may be established. The type will vary according to the size of the community and the desired method of meeting the local situation.

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THE FUNCTIONS
OF A
RECREATION BOARD OR COMMISSION

1. The full interpretation of the recreation program to the public, pointing out the social, moral, physical and economic benefits.
2. The development of social, political and financial support for the commission's activities.
3. The maintenance of high standards in recreation leadership and in the community's program.
4. The selection of an executive director, and definition of his powers and duties.
5. The appointment of all employes upon the recommendations of the executive.
6. The consideration and formulation of all major policies.
7. The approval of programs.
8. A continuing appraisal of the effectiveness of the director and staff in administering the program.
9. The approval of operating budgets and the securing of funds.
10. Close examination and authorization of all expenditures and an annual legal audit of all accounts.
11. Presentation to the public of an annual report on all activities and expenditures.
12. Consideration of all future needs of the community and of the recreation department, and the development of means for meeting those needs.



A Quiet Corner at the Crispus Attucks Center, Lancaster

PROGRAM PLANNING AND CONTENT

A well-balanced recreation program should offer freedom of choice in a wide variety of activities and interests during the leisure-time periods of all youth and adults. The program should be planned in advance, kept elastic, and given all the publicity possible.

An inclusive program, serving all ages and both sexes, regardless of race, creed, color, economic or social level, means more than just a summer playground program for children or an athletic program for the athletic-minded. It may not be possible to embark upon a full-scale program at once, but certainly there should be provisions for continuous growth in order to serve the needs and interests of the public.

The program should offer free instruction and guidance in most, if not all, of the following fields and activities:

1. Arts and crafts
   a. Fine arts—charcoal, pencil, water colors and oils.

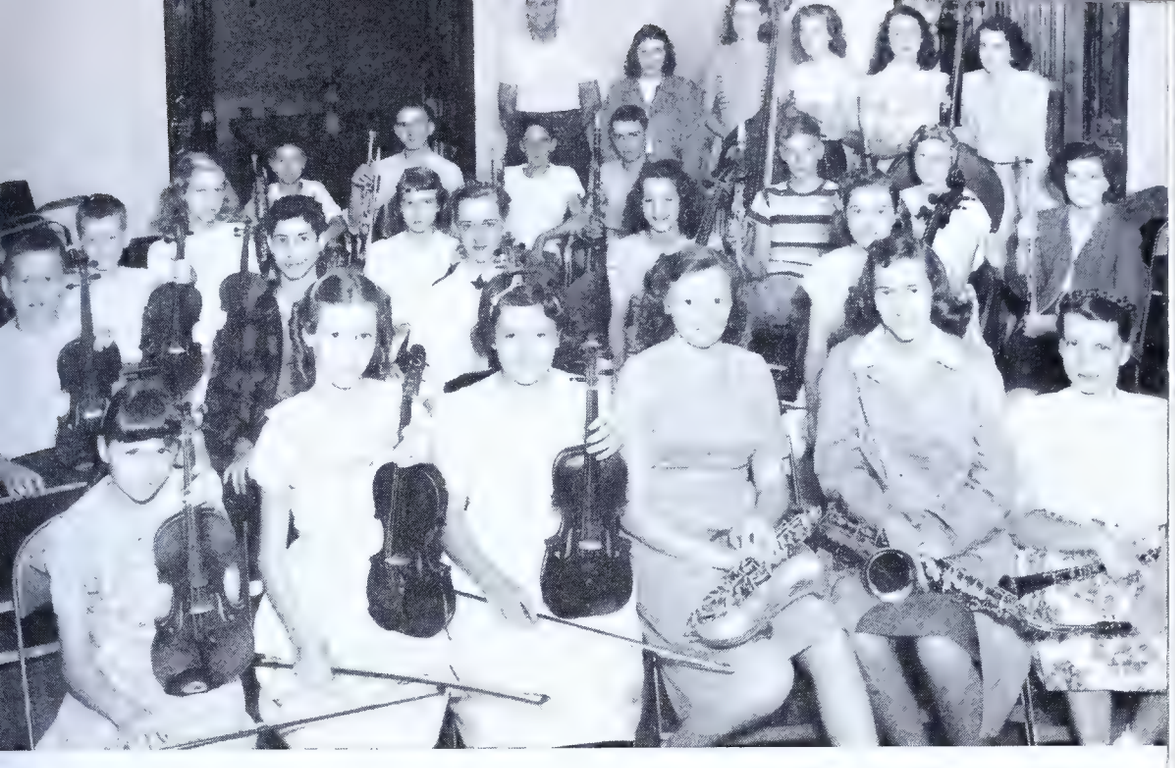
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Mixed Emotions at a Lancaster Field Day

   b. Artcrafts—metal work, plastics, leather, felt gimp, woodwork, weaving, reed work and ceramics.

2. Dancing program
   a. Social, folk, square, clog and tap.
3. Dramatics program
   a. Plays, festivals, pageants, stagecraft, playwriting and production.
4. Music program
   a. Band, orchestra, choral groups, operettas and music appreciation.
5. Nature study and camping program
   a. Naturecraft, campcraft, woodcraft, camping, boating, hiking and biking.
6. Social activities program
   a. Parties, dances, games, picnics.
7. Sports program including all types of major and minor sports



Sunbury's Future Symphony Orchestra

a. Major—Baseball, softball, basketball, football, touch football, tennis, boxing and track events. (Whenever possible arrange for competition in the above sports through league play, keeping in mind the age and weight groupings.)
b. Minor — Archery, table tennis, marbles, quoits, horseshoes, badminton, volleyball, types of relays and other low organized games.
c. Individual and Group Sports—Golf, swimming, diving, skating, coasting, tobogganing, skiing, hiking, biking and hobbies.

8. Special activity program
   a. Spring, summer and fall playgrounds with balanced inclusive programs of all high and low organized games.
   b. Clubs for all age groups in any field of activity.
   c. Field days, mass athletic meets, pageants, tournaments and holiday celebrations.

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Clairton's Municipal Pool

AREAS AND FACILITIES

Each community should survey its available areas and facilities for an all-inclusive, indoor-outdoor public recreation program. On the basis of the findings of the survey as to community interest and financial ability, definite plans can be made to meet present and future needs. In remodeling existing areas and facilities, or in the planning of new ones, maintenance and operation costs may be kept at a minimum through careful planning.

Areas and facilities are the tools without which community recreation cannot succeed.

All public buildings, grounds, and equipment should be made available for public recreation insofar as this is possible without disrupting the established use of these areas and facilities. All privately-owned recreation areas and facilities should be correlated into the community program to avoid duplication of facilities and personnel.



Winter Sports at a Montgomery County Park

Examples: Public school buildings, their grounds and certain equipment should be made available for the public recreation program after school hours, in the evenings, and in all vacation periods except Sundays and legal holidays. Public parks, libraries, auditoriums, community halls and church social rooms should all be used for the programs. Private clubs, Y.M.C.A. and Y.W.C.A. facilities should also be utilized, for no one agency is capable of doing a complete job alone. The pooling of areas, facilities, equipment, and leadership into one community program is the most economical and efficient method of operation.

In considering the total recreational area for any community it is well to keep in mind these pertinent facts:

1. Standards for outdoor facilities—

The number of outdoor and indoor facilities necessary to house a community program depends upon the population to be served.

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A Shady Corner on a Columbia Field Day

a. Neighborhood Playlots — 2,000 to 10,000 square feet of play area are recommended for 40 to 60 children under 12 years of age. They should be located to serve an area with a maximum radius of ¼ mile.

b. Neighborhood Playgrounds—three to seven acres of play area are recommended for every unit of 5,000 population. They should be located to serve an area of ½ mile radius.

c. The Playfield—fifteen to twenty acres of play area are recommended for a community of 15,000 to 20,000 population. It should be located to serve an area of one mile radius.

d. The Community Recreation Park—thirty or more acres; 1 acre per 1,000 people minimum. A park should be planned so that 1/3 of the area can be used for active recreation, 1/3 for picnic purposes and 1/3 for other facilities such as a band shell, a swimming pool, or an indoor recreation center. It should be located to serve an area of one mile radius or more.



Sand Sculptors at Work on a Masterpiece

2. All areas and facilities should be made safe for all ages, and particularly the age group which they are designed to serve.

3. In planning areas and facilities, obtain professional advice from a recreational consultant and a landscape architect.

4. For growth and expansion, surveys should be made, showing the trends of the population and the changing pattern of needs.

5. Careful planning and functional design have much to do with keeping maintenance and operational costs at a minimum.

The program should not be delayed because perfect areas, facilities and equipment are not available immediately. Intelligent, well-trained leadership will always take advantage of any available areas, facilities and equipment. To improvise and to remember that "necessity is the mother of invention" is the foundation of success for many new recreation programs.

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PARKS AND PLAYGROUNDS

OF A TYPICAL PENNSYLVANIA COMMUNITY SHOWING
RECREATIONAL AREAS AND FACILITIES TO BE DEVELOPED



AS A PART OF THE
COMPREHENSIVE COMMUNITY PLAN

N

S C A L E
800' 0 1/4 MI 1/2 MI

L E G E N D

NEIGHBORHOOD TOT LOT .....
PLAYGROUND.....
PLAYFIELD.....
COMMUNITY PARK & PARKWAY .....

1/2 MI. 1/4 MI.

Pennsylvania State Planning Board

The facing page illustrates a physical plan for the development of recreational areas and facilities in a typical community. In most cases, playgrounds and tot lots are adjacent to the grade schools, while the junior and senior high schools have large playfields included in their site plans.

Provision for easily accessible passive recreational areas for the older age groups is shown by the development of the river front as it flows through the city. As in many mature towns, the railroad and industry have usurped the remaining river bank. In addition to the river front park, the proposed parkway adjacent to the circumferential route around the community furnishes many sites for passive as well as active leisure time activities.

The one large community park, in the southeastern part of the city includes within its boundaries the single tributary to the river in this area. This stream, in addition to its scenic value is used as a source of pure water for the community swimming pools within the park.

The placing of the recreational facilities in relation to the population which they are to serve is of great importance. Tot lots and areas for small children should not be more than a block or two from their homes. This is indicated on the map by circles of one-quarter mile radius. Recreational areas for children of higher age groups serve much larger areas, which are indicated by the circles of one-half mile radius. Distributed throughout the river front park, within the parkway, and in and near the playgrounds, playfields and parks are the facilities for the population ranging from the ages of sixteen to thirty and from thirty to eighty.

In planning for a community, the role of recreation is becoming increasingly vital, but sound community planning is equally important to the success of a recreational program. Only through such planning can areas and facilities be located where they can serve the most people safely and easily.

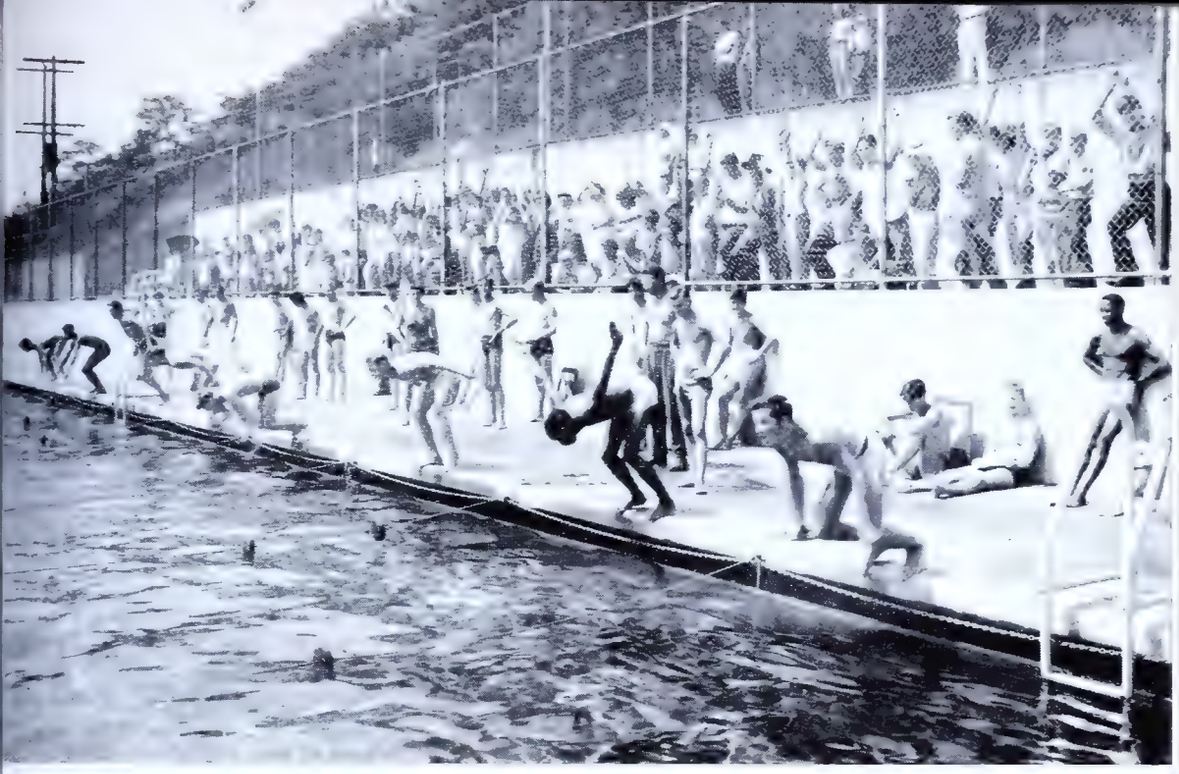
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Before and After

Wasteland in Latrobe becomes a Popular Athletic Field





Swimming is a Favorite Sport in Pittsburgh

ESSENTIAL RESPONSIBILITIES TO THE PUBLIC

The establishment and growth of a community recreation program depends upon a good public relations policy.

The local recreation director, his staff of workers, and the members of the managing board should develop an enthusiastic public relations program, using all available media for interpreting and promoting community leisure-time opportunities.

All local means of advertising, publicizing, and interpreting the program to the citizens should be explored and utilized. The following are suggested as some of the important lines of action:

1. Invite your public to assist in planning the program.
2. Hold frequent meetings or conferences where the public may witness one or more well conducted activities.
3. Make use of photographs, motion pictures, exhibits and demonstrations.

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Pottstown's Dolls on Parade

4. Maintain good relations, with local or nearby radio broadcasting stations. They always welcome good program features and will announce special events.
5. Develop a good advisory council to assist with the community long-range plan.

Publicity should be aggressive, continuous, dignified, easily understandable, and designed to reach all the people.

TRAINED LEADERSHIP A "MUST"

The best, well qualified, and trained leadership is none too good, for the success of any recreational program depends more upon leadership than any other factor. In fact, a community may establish an adequate budget, possess the very best facilities, purchase the best equipment and yet fail miserably in achieving a good productive well-balanced program, because of poor leadership.

The personnel required to conduct a community recreation program should be comparable in professional



Not all Games are Noisy

training and personal qualifications with the personnel in a public school system, or a public health or welfare department. *Insist on having one thoroughly trained, full-time recreation executive, who will be responsible to the legal managing board, and who is employed the year round.*

The managing board or commission charged with the selection of personnel should consider the following suggestions:

1. Establish a fair personnel policy that will insure all workers of security and advancement, and one that demands an efficient performance of duty.
2. Check on standards and qualifications for recreational personnel.
3. Establish a fair salary schedule.
4. Establish a rating system based on merit.
5. Establish responsibilities for each position or task.

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SOURCES OF TRAINED RECREATION LEADERS

1. Pennsylvania State College offers a four year undergraduate course with a major in recreation, and likewise, a graduate course leading to the doctors degree in recreation.

   Pennsylvania State College has an established placement bureau for recreation executives and leaders.

2. Temple University and the Universities of Pittsburgh and Pennsylvania offer courses in special phases of recreation.

3. The National Recreation Association, 315 Fourth Avenue, New York, New York, offers the following services.

   (a) A Trained Recreation Personnel Placement Bureau

   (b) A Leadership Training Institute service.

4. Your State Planning Board recreation consultant will gladly assist any community in securing a trained, experienced, recreation executive.

A PROGRAM FOR PROFESSIONAL GROWTH

All recreation personnel should join the Pennsylvania Recreation Society and thus affiliate with our National professional group, the American Recreation Society. Likewise, all recreation executives should become affiliated with the National Recreation Association, our one national recreation service organization.

Recreation executives, board members, and program personnel should attend the annual State Recreation Conference and the National Recreation Congress.

Professionally trained and experienced recreation executives recognize the need for holding in-service training institutes for their entire staff at least twice each year.

All communities sponsoring public recreation programs may call upon the State Planning Board to assist them in their recreation problems, including training programs.

Recreation personnel should avail themselves of the recreation training credit courses offered through The Pennsylvania State College extension centers and likewise the non-credit training programs co-sponsored over the State by the State Planning Board and the Public Service Institute.

Family Camping at Cherry Spring State Park



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WHERE A COMMUNITY IS PROVIDED WITH ADEQUATE RECREATION FACILITIES, SUCH AS PUBLIC OR PRIVATE PARKS, SCHOOL PLAYGROUNDS, ATHLETIC FIELDS, POOLS, GYMNASIUMS, MEETING ROOMS, AND SHOPS THAT CAN BE USED FOR THE PUBLIC PROGRAM; WHERE AN ADEQUATE BUDGET IS EARMARKED FOR PUBLIC RECREATION; AND WHERE THE LEADERSHIP IS SELECTED ON MERIT, THE RECREATION PROGRAM WILL BE SUCCESSFUL.

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APPENDIX A

FINANCING PUBLIC RECREATION

Budget

Annual funds specifically earmarked for recreation may be secured by:

1. Appropriation. The most common method of securing funds for a community recreation program for playgrounds, parks, etc., is by an appropriation from the city, borough, county, township, or school district treasuries. This appropriation is earmarked for specific recreational purposes. Over 50 per cent of the communities having a recreation board secured funds through appropriations.

2. Tax Levy. A special tax, not to exceed two mills on the dollar of the taxable property in the political subdivision, may be levied for this purpose, under the State Enabling Act.

3. Extension Education Funds. Through Extension Education it is possible to channel State monies through the school districts to assist a community recreation program. This money may be used only for leadership and is subject to the regulations of the State Extension Education Act of 1925. This act may be found in Article 41 of the School Laws of Pennsylvania. The Extension Education Act was amended to specifically include recreational or social services as part of extension education by Act 141 of the Session of 1947 (P. L. 324).

4. Community Chest. In many communities money is appropriated from the community chest for public recreation purposes.

5. Private Gifts or Endowments. The growing appreciation of public recreation as a necessary public service and as a sound investment has attracted the attention of many private citizens and local business concerns. There are very few communities now maintaining a public recreation service that have not received private gifts of money, facilities, or equipment.

An established appropriation from the governing bodies of the borough, city, township, county, or school district is preferable, as recreation then becomes part of the annual budget, and funds for its maintenance may be counted upon from year to year.

Recommendations

All Pennsylvania communities establishing new recreation departments or enlarging their present services should investigate and consider the following recommendations:

1. Call upon your local school district to share in sponsoring the public recreation program so that your leadership budget might be supplemented by State Extension Education reimbursement. This State aid for leadership must be administered by your local school district.

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2. Public recreation departments should maintain two budgets—
   a. Operation and maintenance
   b. Leadership only—
      1a. Professional or certified personnel for whom you may receive State aid.
      1b. Non-professional personnel not qualified for certification.

According to National survey averages, the leadership cost should represent 65 per cent of the total budget.

All funds received by the recreation department from tax levies, appropriations, donations, or other sources should be placed in a continuing fund, earmarked for public recreation. Under the terms of the State Enabling Act, no part of this fund shall revert to the general fund of the school district, borough, township, or county.

Public recreation, like education, public health, sanitation, safety, police protection, streets, and parks, should be considered a public service worthy of a proportionate share of the public tax monies.

APPENDIX B

RECREATION POSITIONS DEFINED WITH RECOMMENDED STANDARDS

Executive Director or Superintendent

Chief executive officer in charge of a recreation agency and its personnel, and responsible for promoting recreation service for all people of the community. He works with the board and its committees in the formulation of policies, procedures, and programs.

1. Duties. To carry out the policies and procedures established by the board. His duties may be classified as follows: administration, planning and research, publicity and general public relations, supervision of staff, program, finance, areas, facilities, records and reports. In the small community he may be required to perform a variety of duties not listed above.

2. Education and special qualifications. College graduation with majors in education, recreation, or related fields. Study on the graduate level is highly desirable and is especially valuable if taken after a period of practical experience in the recreation field. The Executive Director should possess a high sense of responsibility, a strong personality, good health, initiative, a broad cultural background, and a good sense of humor. He should also be a capable administrator and disciplinarian.

3. Experience. At least three years successful experience in public recreation, including supervision of program, finance, and public relations. The minimum amount of recreation executive experience that should be required varies with the size of the city.

Supervisors of Departments, Districts, or Areas

In charge of recreation services, programs and leadership in a definite department, district or area.

Examples: Supervisor of playgrounds, athletic fields, community centers, social centers, etc.

1. Duties. To be responsible for planning, organizing, coordinating and supervising the program in a particular field or area; to prepare work and time schedules, assign personnel and assure proper and safe use of area's facilities and equipment; to secure full effectiveness of all workers; to cooperate with individuals and groups in the neighborhood so that programs will satisfy and produce results; and to supervise the keeping of all records and reports for the department, district, or area. Supervisor may be called upon to perform all types of duties necessary to carry out the program.

2. Education and special qualifications. In general the same as for the chief executive. Weight should be given to courses in child and adult education, sociology, psychology, community planning, organization, and management. A supervisor should possess a fair knowledge of the philosophy of recreation, and of human needs, capacites, and interests in relation to recreation. He should have or acquire the same special qualifications as those of the executive, including the ability to organize and conduct programs, train and inspire personnel, plan, equip and maintain play areas and facilities. He should be competent to lead and instruct in at least three of these fields—arts, crafts, dance, drama, music, athletics, nature study and camping.

3. Experience. Two years previous experience as a special supervisor; as a playground, playfield, or recreation center director; or in some other recreation position involving executive or supervisory responsibilities.

Supervisors of Special Activities

In charge of one or more special phases of program development. They are primarily staff workers responsible to the chief executive or general supervisor.

Examples: Supervisors of art, crafts, drama, music and social activities.

1. Duties. To plan, initiate, organize, and supervise the program in a particular field; to study and determine community interests and needs in that field; to conduct training institutes for training specialists in the field; to prepare budget estimates for a program and submit reports of activities as requested by the chief executive. In small communities a supervisor of special activities may be called upon to perform all types of duties from sweeping the snack-bar floor to directing a play or concert.

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2. Education and special qualifications. Equivalent to graduation from college, with major or special study in the field or fields in which he is to serve. He should possess a thorough knowledge of the rules, equipment, and facilities for his particular phase of the program. He should be familiar with the various forms of recreation appropriate to his particular fields so everyone may derive enjoyment through participation in the activity. He should also have the ability to interpret his phase of the program to his co-workers, so they may become competent to act as instructors, promoters, and directors.

3. Experience. Previous experience in a public recreation system and as an organizer and teacher in special fields. A participant in a number of recreational activities is very desirable.

Recreation Director

In charge of administering the facilities, staff, and program of a single recreation center, such as playground, playfield, indoor centers, or camp. A recreation director is responsible to the chief executive or the supervisor in charge of his particular department.

Examples: Playground director, community center director, or camp director.

1. Duties. To have full charge of the operation, maintenance, and program of any particular center or area in the public recreation system, including personnel, facilities, equipment, and public relations; to plan and administer an attractive all-inclusive program suitable to the needs and interests of the people in the neighborhood and the public in general; to assure the proper maintenance of the center and to see that all structures, areas, and equipment are always in safe condition; to prepare budget estimates, maintain and submit financial, time, service, and program attendance reports; to follow the general policies adopted by the board in developing neighborhood relations and to cooperate with all groups and agencies; to teach, direct, or supervise all phases of the program in the center, and develop good working conditions and relations with both the paid and volunteer workers. Many small communities will call upon the recreation director to assume all of these various responsibilities, and therefore, he must be a utility man with special qualifications.

2. Education and special qualifications. College education or its equivalent. Courses in recreation theory and practice, adult education, educational methods, and in such activities as athletics, art, crafts, dramatics, music, nature study and club organization work should be included in his preparation. A director should possess a practical knowledge of the organization of leagues, tournaments, exhibits, field days and entertainments. He should have some measure of skill in all types of recreational activities. He should be experienced in selecting and training both paid and volunteer leaders for the program. A good sense of humor,

social balance, plenty of initiative, and excellent health are certainly desirable.

3. Experience. At least two years as an assistant playground or center director, recreation leader, teacher, or worker in related fields, at least one year of which shall have included the operation of a program in an indoor recreation center.

Recreation Leader and Instructor

Personnel who, under general supervision of a director, lead, instruct, and coach a variety of activities, as games and sports of all types, handicrafts, dramatics, dancing, music, social events, and phases of camping.

1. Duties. To assist the director in all ways with the program; to teach skills and conduct organized games; to lead or instruct dancing, art, crafts, dramatics, nature study, and camping; to organize and lead club activities, social activities, and serve in all community-wide events; to care for equipment, supplies, and facilities; to demonstrate safety and first-aid, and assist in training junior leaders for the program; to perform all duties required by the director, supervisor, or chief executive.

2. Education and special qualifications. High school graduation, or its equivalent. Attendance at all pre-season institutes should be required. Capacity for organizing and working with youth and adults is essential.

3. Experience. Experience as a participant in recreation activities. Successful leadership experience in recreation or some allied field is desirable. Boy scout, girl scout, church work and summer camp experience is very valuable.

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APPENDIX C

SALARY RECOMMENDATIONS FOR PROFESSIONAL RECREATION LEADERS

	Yearly Basis (Full Time)				*Hourly Basis (Part Time)*
Population	Under 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
	(Min.)	(Min.)	(Min.)	(Min.)	(Min.)
Superintendent or Executive Director	$3,600	$4,500	$5,500	$6,500	$2.50
Supervisor of Department	3,400	3,600	4,500	5,000	2.25
Supervisor of Special Activity	3,400	3,400	4,000	4,500	2.00
Recreation Director	3,000	3,300	3,600	4,000	1.75
Recreation Leader	2,400	3,000	3,300	3,600	1.50

All local managing boards or commissions should keep three factors in mind when establishing recreation salary schedules:

1. Recreation is education at its best, and, a financial investment. *Good Leadership will pay good dividends.*
2. Short-sighted economy in salary schedules, resulting in employment of unskilled supervisory personnel, can negate all of the good work done by the board in developing fine facilities and programs.
3. Part-time or per session hourly rates for specialists should be higher than hourly rates for full-time work.

Inadequate compensation has no place in the recreation profession.

The above salary recommendations are a composite average taken from statistical surveys in many states across the nation. Where a community budget is inadequate to meet the above recommendations the local public school salary schedule may be used as a fair basis.

APPENDIX D

TO CREATE A RECREATION BOARD (or COMMISSION) FOR THE (CITY, BOROUGH, TOWNSHIP, COUNTY) OF .....

WHEREAS, the Recreation Enabling Legislation, enacted by the General Assembly of the Commonwealth of Pennsylvania, provides that

a. Every civil subdivision of the Commonwealth shall have a general plan of its parks and playgrounds;
b. Every civil subdivision may acquire lands, property, and buildings for the purpose of establishing and maintaining public parks, parkways, playgrounds, playfields, gymnasiums, public baths, swimming pools, or indoor recreation centers;
c. Every civil subdivision may provide for supervising, equipping, and maintaining public recreation areas and facilities through any existing body or through a recreation board;
d. All civil subdivisions may levy and collect such special taxes (not to exceed 2 mills) as they may deem necessary to finance the operation and maintenance of their recreation system, and they may make direct appropriations for same;
e. Any city, borough, township, county, or school district may perform the above public service jointly with any combination of civil subdivisions; and

WHEREAS, it is the considered judgment of the (governing body or bodies of the civil subdivision or divisions) ..... that adequate public recreation programs and facilities of the (civil subdivision) of ..... can best be advanced by placing the recreation system under the supervision and direction of a legally constituted recreation board or commission authorized by the Recreation Enabling Legislation of Pennsylvania; therefore, be it

Resolved, By the (city, borough, township, county, school district) .....

Section 1. That there is hereby created a recreation board known as the "..... of ....."

Section 2. That the board shall be composed of five members, to be appointed by the ..... (mayor, council, county, or township commissioners, or township supervisors), with the power to provide, conduct, and maintain public recreation areas, facilities, and centers subject to all the responsibilities of the Recreation Enabling Legislation. The board members shall serve for terms of five years, and until their successors are appointed, except that the members first appointed shall be so appointed that the term of

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one member shall expire annually thereafter. Vacancies shall be filled in the same manner as original appointments and for the unexpired term. Members shall serve without pay.

Section 3. That the recreation board shall appoint from its membership a chairman and such other officers as it may deem necessary for the orderly procedure of its business, and may adopt by-laws, rules, and regulations covering its procedure not inconsistent with the provisions of the State laws. The recreation board shall, from time to time, make rules governing the operation and conduct of the recreational facilities operated by the board. The board shall hold regular meetings at such times and places as it may designate.

Section 4. That the recreation board shall maintain, operate, and supervise the public parks, playfields, and all outdoor and indoor recreation areas and facilities owned or controlled by the .....

Section 5. That the recreation board may accept any grant, gift, bequest, or donation of services, equipment, real estate, or money from any individual or group, to be used as specified by the donor, or by the terms of acceptance. The recreation board shall have no authority to enter into any contract or incur any obligation binding upon the ..... , other than current obligations or contracts to be fully executed within the then current fiscal year, and all within the budget appropriations made by the governing body of .....

Section 6. That the recreation board shall have the power to appoint an executive director or superintendent of recreation, who possesses the necessary qualifications and who has demonstrated by actual work his ability to organize and direct a community recreation system, and supervise the activities of such other personnel as may be deemed necessary in carrying out the program.

Section 7. That funds appropriated by the governing body of the ....., and budgeted to the recreation board, shall be disbursed by the fiscal disbursing officer of the ....., upon vouchers issued by the recreation board and within the budget appropriations made. Funds received by the recreation board from sources other than budget appropriations shall be desposited by the ....., to the credit and for the use of the said board, and disbursed as the above budget funds are disbursed, except that funds received by gift, bequest, or otherwise shall be disbursed in accordance with the terms of such gift or bequest, or the terms of the acceptance thereof.

Section 8. That the recreation board shall make full and complete reports to the governing body at such times as

may be designated or requested by the governing body. The fiscal year of said recreation board shall conform to that of the .....

Section 9. That such powers as are now or may hereafter be provided by statute of the Commonwealth of Pennsylvania, or by ordinances of the ..... relating to the development and operation of recreation systems, public parks, and playgrounds, are hereby vested in the recreation board, to be exercised by it subject to any and all restrictions contained in such powers and ordinances.

Section 10. That all resolutions and ordinances of the ..... in conflict herewith are hereby repealed.

Section 11. That this resolution shall be in full force and effect ..... days after its passage.

Adopted this ..... day of 19

.....

.....

APPENDIX E

LEADERSHIP

1. The Pennsylvania State College, Irving Hall, State College, Pennsylvania. Recreation Personnel Placement Bureau.

PRELIMINARY COMMUNITY RECREATION SURVEYS

1. The State Planning Board, Department of Commerce, Harrisburg, Pennsylvania. Mr. Kenneth W. Abell, Recreation Consultant.
2. Pennsylvania State College Extension Service, School of Physical Education and Athletics, State College, Pennsylvania.
3. National Recreation Association, 315 Fourth Avenue, New York, New York.
4. Division of City Planning and Landscape Architecture, Department of Internal Affairs, Harrisburg, Pennsylvania.

PROFESSIONAL SURVEYS AND PLANS

Before a community takes final action in the development of their recreational areas and facilities, the services of a professional landscape architect and site planner should be obtained. We strongly recommend an architect experienced in the functional use of recreational areas and facilities.

FILMS

(Rental rates vary and should be checked with each distributor for accurate charges. To insure timely receipt of the films, plan film showings and book film in advance.)

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Pennsylvania State College Audio Visual Aid Library, State College, Pennsylvania.
American Legion National Headquarters, Indianapolis 6, Indiana.
American Red Cross, 40 East 49th Street, New York 17, New York,
Pennsylvania Department of Commerce, Tourist and Recreational Bureau, Harrisburg, Pennsylvania.
Association Films (YMCA), 347 Madison Avenue, New York 17, New York.
U. S. Children's Bureau, Social Security Administration, Federal Security Agency, Washington 25, D. C.

RECREATIONAL RESOURCES OF THE COMMONWEALTH INFORMATION AND CONSULTANT SERVICES

Many departments of the State Government, including the Department of Labor and Industry, the Department of Military Affairs, the Pennsylvania State Police, the Department of Health, the Department of Welfare, the Board of Fish Commissioners, and the Pennsylvania Game Commission, are concerned in some of the problems which may be met with in organizing a community recreation program. In addition, the following agencies can supply specific information:

Department of Commerce

Apply to the Tourist and Recreational Bureau for maps, camping sites, camp facilities, tourist motels and cabins, summer and winter sports areas.

Apply to the State Planning Board for information on community planning, recreation planning, preliminary site planning and recreation consultant services.

Department of Internal Affairs

The Division of City Planning and Landscape Architecture may be called upon for consultation and assistance in local park and recreational site planning.

Department of Forests and Waters

The Bureau of Parks in the Department of Forests and Waters, Harrisburg, Pennsylvania, will furnish, upon request, detailed information pertaining to recreation facilities, equipment and program possibilities in all State Parks.

Department of Public Instruction

All problems pertaining to public recreation programs, instruction, certification and the use of public school facilities and equipment involve the local School District Board. Information as to the powers and duties of local school districts with respect to recreation may be secured from Division of Extension Education of the Department of Public Instruction, Harrisburg, Pennsylvania.

SELECTED PUBLICATIONS OF THE PENNSYLVANIA STATE PLANNING BOARD

Publication No

*1—Preliminary Report. 682 pages. 152 charts, December, 1934.

*10—Drainage Basin Study. 3 vols., 611 pages, 1937.

15—Recent Industrial Trends and New Employment Opportunities in Pennsylvania.

16—Retail Trade in Pennsylvania, 1946.

17—Industrial Utility of Water in Pennsylvania. Chemical Character of Surface Water, 1944 to 1946. 1947.

18—The Pennsylvania Zoning Primer (Revised), 1948.

19—Local Powers for Community Development, 1948.

21—Planning and Zoning Powers and Procedures in Pennsylvania, 1949. Vol. 1. (Townships of the Second Class, Counties, Regions.)

22—Planning and Zoning Powers and Procedures in Pennsylvania, 1950. Vol. 2. (Cities, Boroughs, First Class Townships.)

A limited number of those listed are available for distribution until the present supply is exhausted. Those marked with an asterisk are now out of print but may be seen in representative public libraries.

The following issues of **Pennsylvania Planning** are still available.

Local Tax Rates, May-June, 1940.
Community Self-Appraisal (Revised Edition), April, 1942.
Population, October, 1942.
Handicrafts in Post-War Planning, May, 1943.
Plastics, July, 1943.
*Air Photographs, February, 1944.
Light Metals and Stainless Steel, August, 1944.
Topographic Mapping Needs, February, 1945. (For limited technical distribution.)
Community Action for Local Self Development, July, 1945.
Conservation, August, 1945.
Forest Resources, November, 1946.
Soil Conservation, September, 1947.
Minerals Conservation, December, 1948.
Know Your Pennsylvania, September, 1949.
Comparative County Data, August, 1950.

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PLANNING AND ZONING
POWERS AND PROCEDURES

VOLUME ONE

REGIONS
COUNTIES
TOWNSHIPS
OF THE
SECOND CLASS

HARRISBURG
1949

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PUBLICATION 21
REVISED EDITION

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PENNSYLVANIA DEPARTMENT OF COMMERCE

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VOLUME I

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THIS TEXT *is a revision of the series on Planning and Zoning Powers and Procedures, originally prepared by Russell Van Nest Black with the assistance of members of the State Planning Board staff. The first edition has been widely distributed.*

Changes in the enabling acts have made necessary this revision, which is not designed to provide an exhaustive text on the various phases of local planning, but rather to acquaint the reader with the basic purpose, principles, and practice in a field which becomes of increasing interest and importance every year.

Specific questions in regard to local problems may be addressed to the State Planning Board of the Department of Commerce.

A list of the more recent publications of the Planning Board, including "The Pennsylvania Zoning Primer" and "Local Powers for Community Development," will be found on the inside back cover of this publication.

A Bibliography of recent general publications on Planning and Zoning will be supplied on request.

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FOREWORD

Planning and Zoning are not new activities of government, nor is it a new principle that ownership does not confer absolute rights to harm others through the use of one's property. The social responsibility in the ownership of real estate is clearly recognized in the Code of Hammurabi, 2200 B. C.

Planning has a long and honorable history. It is almost as old as urban life itself. The first known town planner, Hippodamus of Miletus, born 480 B. C., "Introduced the principle of straight wide streets, and first of all architects made provision for the proper grouping of dwelling houses, and also paid heed to the combination of the different parts of a town in a harmonious whole, centered around the market place." [1]

The Greeks, the Romans, and the Italians of the Middle Ages developed and adapted the Greek traditions. The English in the reign of Edward I (1239-1307) held the first recorded conference of town planners, a group of fifty "wise men of the most knowing and most sufficient who knew best how to devise, order, and array a new town to the utmost profit of the King and the merchants." [1] The profession of planning is, therefore, a very old one, and its necessity has long been recognized.

Here in America, Penn's plan for his city on the Delaware and L'Enfant's plan for Washington established traditions and patterns adequate for their time, but not always fortunate for the future. Penn's plan, which became the typical American checkerboard pattern, lacked adequate provision for radial highways, and lim-

[1] Patrick Abercrombie, "Town and Country Planning."

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ited street widths to the requirements of horse and wagon. L'Enfant's provided so many radial avenues that building areas were of inconvenient shapes and sizes, and traffic congestion has become a very serious problem.

From such experiences as these, however, the modern art and science of town planning was evolved. The rapid development of industrialism and of motor vehicle transportation, with the consequent growth of urban communities, has greatly enlarged the responsibility of planning, and has given it a strong economic slant. The mobility of modern life has carried far into the countryside the typical urban problems of traffic density and has emphasized the conflict among residential, agricultural, commercial, and industrial land uses.

Planning in America at every level has of necessity taken the form of dealing with the unexpected and often deplorable consequences of rapid urban and suburban growth, with the encouragement of economic development to support an increasing population, with the provision of adequate facilities properly located to be of maximum public use, and with the hard fact that 33,000,000 automobiles and 7,300,000 trucks and buses now travel our Nation's highways.

Planning is an attempt to make the best possible use of every advantage of location, resources, or facilities available to a community, to adapt new developments to the established trends of growth, and to overcome, so far as possible, any unnecessary handicaps resulting from changes in the patterns of transportation, in the character of neighborhoods, or in community needs not foreseen in the past.

Zoning, on the other hand, is primarily a form of conservation. Its aim is to preserve the values created in every community through the efforts of the present and earlier generations, to maintain the quality of community living and to prevent the useless dissipation of the residential, commercial, or industrial advantages on which the community's growth has depended, and upon which it must depend in the future.

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It is, therefore, an important and necessary instrument for making effective both urban and rural plans for orderly development and growth.

The waste arising from the decay of established neighborhoods is as real a danger as soil erosion or the depletion of our forests by clear-cutting or fire. The invasion of uncontrolled commercial developments into residential neighborhoods is estimated to have cost the city of New York, before the application of its first zoning laws, a property loss of over a billion dollars a year—far greater than the annual fire loss of that great city.

In many of our smaller communities great harm has been done through the sacrifice of that security in the character of a property which is essential for stable or enhancing values.

Zoning, however, is only one of the several devices by which a community may direct its development along desired lines. The enforcement of sanitary and building codes, the control of subdivisions, the provision of proper facilities for residence, business, or industry, are all fully as important as any restrictive measures aimed to prevent a single land-owner or group of owners from destroying the character of a neighborhood for immediate profit.

Zoning depends for its effectiveness on a developed plan, and the success of a plan for a community's future depends in its turn upon the purposes on which the citizens of the community can agree. For this reason public opinion must be aroused and must emphatically express itself before any program of planning and zoning can be successful.

Leadership can crystallize a community's pride in its character and make it articulate. It can bring common sense to bear in achieving the community's purpose, but no sound community plan or zoning ordinance can be successfully imposed from above. At every point in the planning and zoning process the community should have an opportunity to express its will. The community plan and the zoning ordinance can only apply the best experience and skill available to carry out the community's will to the utmost advantage of all its people.

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While the planning enabling laws of Pennsylvania emphasize the preparation of plans for the physical growth and development of their community, it has been evident for a number of years that a successful local plan must also be concerned with the growth of the community's commercial, industrial, recreational and cultural resources, and the development of conditions under which those resources may be put to the maximum use. It is not unlikely that legislation will soon specifically emphasize the powers of planning bodies to consider such factors and to prepare programs for the development of local resources and the promotion of local industry. Meanwhile many active planning bodies have already undertaken such a responsibility to the great benefit of the areas in which they operate.

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PLANNING AND ZONING

POWERS AND PROCEDURES

CHAPTER I

The Need for County and Township Planning and Zoning.

Cities, boroughs and first class townships in Pennsylvania have had legislated planning and zoning authority for many years. Machinery for State planning, including the creation of a State Planning Board with specified powers and duties, was set up by the State Legislature in 1936. The 1937 State Legislature completed the picture of planning and zoning enabling authority by extending planning and zoning powers to counties from the 2nd to 8th classes, inclusive, to groups of counties or municipalities or counties and municipalities, working through joint or regional commissions, and to townships of the second class, for zoning, only.

While second class townships have no specific authority to appoint a Planning Commission, their authority to develop and enact zoning ordinances specifies that such ordinances shall be "in accordance with a comprehensive plan." This in effect gives the Township Zoning Commission a directive to perform most of the functions of a Planning Commission. Supervisors are authorized to expend funds for technical assistance in preparing zoning regulations.

With the extensive use of the automobile and widespread availability of electric service have come an extension of homes, businesses, and industries into the rural areas, especially along the more heavily traveled highways. Zoning is needed to bring order into the development of these "road-

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towns," to protect rural property values, to preserve the usefulness and attractiveness of highways built at large public expense, and to save Pennsylvania's unsurpassed countryside from despoliation by thoughtless, careless, or unscrupulous uses of adjacent private property.

Menace of Rural "Problem Areas"

Analyses of the increasing cost of local government indicate that, in the interests of public economy and in the long-time interests of agriculture, steps could well be taken toward the gradual withdrawal of unsuitable lands from active farming use and toward the gradual retirement of sparsely settled areas where struggling families are unable to produce enough from the land to pay for even a small part of minimum public services such as those of schools and roads. By zoning the least suitable lands against agricultural settlement and use, unwise investment by the inexperienced on unprofitable land could be checked, forest growth could be promoted, and the year-round rural population limited to locations more readily accessible to state services, with benefit to the people concerned and to the Commonwealth.

County planning has the same validity and holds the same potential benefits as does planning for cities. In some ways, county planning is even more important and more promising of results than is city planning because much of suburban development takes place in county territory, outside of municipal jurisdiction with no adequate guidance or control unless such guidance or control are supplied by the county. Wherever public improvements are made, by whatever jurisdiction or in whatever territory, much of general benefit and public economy will accrue through farsighted planning.

In many counties the pressing need for zoning protection,—especially of the urban type dealing with residential and highway restriction,—may be imperfectly appreciated or not be appreciated at all

by many townships. This isolated or scattered interest may fail in stimulating effective country-wide interest and action. In such cases, individual townships may now proceed to zone themselves under the powers conferred upon them by the township zoning act.

Cost of Planning vs. Not Planning

In all such new governmental ventures there inevitably arises the question of cost. Planning and zoning are relatively inexpensive as compared with the benefits to be derived; but good planning and zoning cannot be had without some public expense. As it has been aptly put, the "Question is not whether we can afford to plan, but whether we can afford not to plan." By far the largest cost of planning is that of making the initial maps and studies. Continuation studies and plan administration usually require only nominal outlays. The initial cost of planning is properly to be regarded as a long-term investment paying large dividends over a long and indefinite period of years.

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PROGRAM FOR COUNTY PLANNING COMMISSIONS IN PENNSYLVANIA

The Board of County Commissioners appoints a planning commission and provides it with working funds.

The planning commission organizes, employs staff and technical assistance and after making basic studies and surveys, prepares comprehensive county plan.

The county commissioners enact resolutions and ordinances adopting the maps and plans, and thereafter refer all proposals for public works to the planning commission for review and recommendation.

The planning commission adopts platting regulations; exercises platting control authority over land subdivision activity in the county area outside of cities and boroughs; and reviews and reports upon all land subdivision plot maps submitted by city and borough authorities.

The planning commission reports on all project proposals for public improvements; continues study and makes desirable changes on county plan; assists and coordinates local and regional planning programs; and maintains an active program of public education as to community needs.

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Chapter II

COUNTY PLANNING PROCEDURES

(Under Act No. 434, Laws of 1937)

Although there are now several hundred county planning boards or commissions in the United States, many of them with years of successful operation, the county planning powers are still little used in the Commonwealth of Pennsylvania. This may be due in part to the large number of cities and boroughs in the Commonwealth, each of which has the right to establish its own planning commission.

There are, however, many situations in which the county planning commission, with its authority to control subdivisions in rural areas and to regulate developments along the highways, would be of great use in preserving the recreational possibilities of a county, or in controlling the spread of unneeded or undesirable roadside developments. The establishment of a large industrial plant in a typical rural county might give rise to problems with which no individual township could deal.

It must also be remembered that in various periods in the past, changes in the industrial outlook have led to a considerable movement of urban people into the countryside. Under such circumstances the lure of cheap land in areas of depleted soil, suited only for forest growth, has caused great economic loss on the part of such settlers and has frequently occasioned heavy expense to local governments and school districts.

The protection of land in the neighborhood of State parks or vacation areas from developments which might cost the residents of the county substantial losses in income from recreation visitors

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or prove harmful to the social life of rural communities may also make advisable a program of county planning.

It is also possible that through a county planning commission efforts for the encouragement of industry or the elimination of conditions discouraging to industrial growth might be initiated.

Under such circumstances the county commissioners would be much more inclined toward the appointment of a planning commission, if such action were requested by a group of widely representative and influential people or citizen organizations. There need not be a great number of backers at the start. One or two men or women sufficiently interested and sufficiently persuasive can start the ball rolling. Individuals and interested groups can obtain from the State Planning Board and other readily available sources the necessary information as to the values of county planning and as to the success of its operation in other places.

Following appointment of the Planning Commission and during the course of preparation and administration of the county plan there must of course be much general public education, through the press and by printed reports in the public schools, and by other means, as to the nature of planning and its objectives. In the last analysis, success in carrying out any long-time plan is largely dependent upon public understanding and support.

Outline of Procedure

The several steps in county planning under the State Enabling Act, briefly stated, are as follows:

1. Arrival at decision by the County Commissioners with or without demonstrated public support, to broaden and improve the local county government by adding the function of planning as defined and authorized by the Enabling Act.
2. Appointment of an official County Planning Commission, by the County Commissioners, in number and personnel and with the powers and duties, as set forth in the Enabling Act.
3. Appropriation of working funds to the County Planning Commission in proportion to the requirements and the size of the planning job in the county concerned.

4. Making the necessary factual surveys, maps, and preliminary studies of industrial trends, mineral, and forest resources, soil conditions and land use, by the Planning Commission.

5. Preparation of a comprehensive plan for the long-time development and improvement of the county, by the Planning Commission,—this plan to include: indication of land-use potentialities and general development probabilities of the several parts of the county; future roads and recommended widenings, extensions, or vacations of existing roads; future recreation areas and lands probably to be needed for other public purposes; industrial resources and possibilities; a zoning ordinance and map, if the Planning Commission has been given zoning powers as permitted under the Act, and such other elements in sound physical development of the county as may be locally important.

6. As has been mentioned before, the County Planning Commission may be designated by the County Commissioners to serve also as a County Zoning Commission operating in this respect under Act 435, Laws of 1937. In such case, the preparation of a zoning ordinance and map should follow immediately after or be carried on simultaneously with steps 4 and 5, above.

7. Submission of comprehensive plan, in whole or in part, by the Planning Commission to the County Commissioners, with recommendations and covering report. When the Planning Commission is serving also as the Zoning Commission, special procedures as provided by the County Zoning Act are to be followed in submitting recommended zoning ordinance and map to the County Commissioners.

8. Continued study and development of the county plan by the Planning Commission and the making of further or revised recommendations to the County Commissioners as from time to time may be found desirable.

9. During the course of plan making and continuously thereafter the Planning Commission should perform, among others, these additional legislated functions:

a. Review of and reporting upon all land-subdivision plats submitted to local authorities within the county.

b. Encouragement of local planning activities so far as they may concern the integrity of the county plan or the proper coordination of local improvements and general development.

c. Preparation of reports upon all improvement projects initiated by the County Commissioners,

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prior to final adoption thereof by the County Commissioners.

d. Study all proposed State highway, park, and institutional plans which might concern the county's welfare, and make recommendations as to needed future State public works within the county's area.

The First Step in Planning

The first official step in a planning program is the creation of a planning commission by the governing body. Ways and means of gaining sufficient public and official recognition of the need for planning, to bring about the creation of a planning commission will vary for different communities. Usually, no matter how well it may itself be convinced, the local governing body will not proceed with the appointment and financing of a planning commission until there has first been some expression of favorable public opinion. This does not mean that there need be an advance "mass" movement for planning, but that it will be helpful to the governing body to have the expressed support of local civic organizations and of a fair number of influential and representative individual citizens. Usually, a very small group of convinced citizens can, by persistent effort, start the ball rolling and ultimately get results. Talks before chambers of commerce, luncheon clubs, women's organizations and similar groups, leading to endorsement of the planning idea, are often effective. And newspaper support, editorially and in the news columns, is important.

Carrying out the county plan, once made, is largely dependent upon widespread public understanding and support, requiring much and continuous education. But such extensive understanding and support are neither necessary nor likely to be achieved prior to official action toward creation of a planning commission. General education can be best advanced by reference to tangible planning proposals once they have been at least tentatively formulated by the planning commission.

The primary function of a county planning commission is the making and administering of a com-

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prehensive plan for future county improvement and development. Then there are supplementary duties including: recommendations as to land subdivision plats in cities and boroughs and approval of land subdivision plats in other areas within the county; review of current improvement projects initiated by the County Commissioners, and expressing opinions or making recommendations with respect to plans and development projects of localities and of various semi-public interests within the county. In the performance of any and all of these duties the Planning Commission must be armed with extensive information about conditions in the county as they exist and about the county's future prospects.

The County Planning Commission and Its Appointment

The County Planning Commission is appointed by the Board of County Commissioners and consists of nine citizens of the County, seven of whom shall not be paid county employees. Members of the Planning Commission, who must be selected in accordance with specified residence and experience requirements, shall not receive compensation but may be paid necessary expenses incurred in connection with performance of their duties. The Commission may incur expenses and employ engineers and other persons within the limit of the funds appropriated to the use of the Commission by the County Commissioners.

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Qualification of Members

The Planning Enabling Act requires that Planning Commission members shall have knowledge and experience in one or another field closely related to some phase of county planning. It is of equal and perhaps of greater importance that members of the Planning Commission be men of broad vision, good judgment, and unquestioned prestige. Above all, an effective planning commission must be non-partisan in its personnel and in its viewpoint.

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The best of planning commissions is helpless without working equipment and funds. The commission must have at its disposal necessary office

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space and sufficient funds to provide needed materials, office equipment, and technical staff or technical advice. The Planning Commission itself is not presumed to be professionally qualified to make the technical planning studies. Nor should the Commission be expected to give sufficient of its time and personal funds to make the necessary surveys, maps and plans even if, by chance, qualified to make them. The Commission must have some public funds and some paid qualified help if it is to contribute a worthwhile service.

Administration Costs of Planning and Zoning

No definite suggestion is offered as to desirable amount of appropriation for county planning purposes. This will vary with the character of the county and with the extent and complication of the planning job, and will vary annually with planning progress (more during the initial stages of planning and less during the administrative and continuation period after the county plan has been completed). There will be still further variation in operating costs according to: (a) the procedure followed, (b) the quality and thoroughness of work desired, and (c) the kind of maps and completeness of information available with which to start. The needed annual appropriation for the first two or three years' work, therefore, may be as little as two to three thousand dollars or as much as from $10,000 to $50,000 for the more populous and urban counties.

General Powers and Duties of Planning Commission

The general powers and duties of the Planning Commission are set forth in Section 502 of the Enabling Act (copy contained in Appendix). Other special powers and duties are conferred by other sections of the Act from 501 to 507.1, as indicated below.

The County Planning Commission, by Act No. 212 of 1947, is given specific authority over land subdivision activities within the county limits, except those located within any city or borough. It is unlawful to record any subdivision plan in any public office without submission to a county

planning commission, if one exists, and any offer to sell land within a subdivision which has not been approved by the county planning commission renders the owner or agent subject to fine or imprisonment. Cities and boroughs have independent power to regulate subdivisions, but must also submit plans to a county planning commission for its report.

Addition of Zoning Powers to County Planning Commission

Section 501 provides that the County Commissioners may give the Planning Commission the additional authority of serving as a county zoning commission with all the powers and duties set forth in the County Zoning Enabling Act (Act 435, Laws of 1937). This is in recognition of the fact that county planning and county zoning are so closely related and so much a part of the same thing that the two jobs can best be carried forward simultaneously by a single commission. The importance and the advantages of tying zoning and planning together in one operation and within the authority of a single commission is discussed in further detail in Chapter III, "County Zoning Procedures."

Under the Urban Redevelopment Law of 1945, P.L. 991, it is the duty of a county planning commission, wherever a county redevelopment authority has been appointed, to inform the authority as to areas needing redevelopment and to supply the authority with an appropriate plan for such action.

Areas needing redevelopment are defined under the law as those which have become blighted because of the unsafe, unsanitary, inadequate, or overcrowded conditions of dwellings, or because of inadequate planning of the area or excessive land coverage by the buildings, or the lack of proper light, air, and open space, or because of the defective design and arrangement of the buildings, of faulty street or lot layout, or economically or socially undesirable land uses.

The plans, which are required to be submitted

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to the authority by the local planning commission, may include the rehabilitation or rebuilding of such an area for residential, recreational, commercial, industrial, or other purposes, including the provision of streets, parks, recreation areas, and other open spaces.

Any county planning commission with a full sense of its responsibilities to the people of the community should also make recommendations to the proper State departments as to needed highway, park, or institutional developments which fall within the local area or its surrounding territory.

The commission should also make a study of the effect of all proposed State public works on their community's welfare, and suggest such changes as may be locally necessary or desirable.

If to the Planning Commission's regular duties there is added the county zoning function, then the cost of operation will be somewhat, although not proportionately greater, inasmuch as the combination of these two related functions works a large economy. Both require the same basic studies.

Collection and Recording of Data

Many of the factual data needed for planning purposes can be obtained from existing maps and air photographs. Other data are in statistical and narrative form. All data should be collected, analyzed, and presented in an orderly and understandable manner. The presentation is usually made on a series of maps supplemented with statistical and descriptive matter.

The important sources of basic data for planning purposes are:

1. *Air Photographs.* Vertical air photographs provide an accurate inventory of the geography, land use, and other physical characteristics of the landscape. Air photographs at a scale of 1:20,000 are available for all of Pennsylvania. Many of these are old (1938 and 1941) and, therefore, limited in their usefulness. However, up-to-date

air photographs of every county will be available through the State Planning Board's new cooperative air photography program by the end of 1950. They will be available at reasonable cost, and complete information concerning them can be secured from the State Planning Board.

For urbanized areas, enlargements of the photographs or special, large scale photographs may be required. Mosaics, made by fitting the photographs together into large units, add to their usefulness and are often desirable.

2. *Topographic Maps.* These show the location of physical features, both natural and man-made boundaries, of civil subdivisions, and indicate by contour lines the elevations and land forms. The Map Information Office of the United States Geological Survey, Washington, D. C., or the State Planning Board can supply information concerning their availability. Although many of these are old, they can be supplemented by air photographs. Most of them can be obtained with a forest overprint.

3. *General County Highway Maps.* These are being prepared from air photographs and other sources, at a scale of 1:62,500. They are available for most counties and should be ordered directly from the Secretary of Highways, Harrisburg, Pennsylvania. They cost one dollar per county. In addition to the highways, railroads, and streams, they show the location of all dwelling units, factories, mines, et cetera outside the limits of boroughs and cities.

4. *Other Maps.* Soil maps, geological maps, transportation maps, erosion maps, forest-cover maps and other special maps.

5. *Other Data.* Data relating to population growth, land use trends, minerals, climate, industrial establishments, quality of water, stream flow, public utilities, and transportation facilities may be obtained from various sources. The State Planning Board should be consulted.

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Preparation of Base Maps

Base Maps. A suitable map should be prepared as a base on which to present the planning data. Existing maps are usually not satisfactory because they contain too much irrelevant information. A scale of one inch equals 2,000 feet is recommended for these base maps. All new topographic maps will be issued at this scale. The base map should contain the county and civil division boundary lines, and principal streams and lakes. A number of lithoprint copies of this map may be made on tracing cloth. These copies should be used as the base for a series of basic data maps which may show such information as the existing use of private and public lands, population density, educational and recreational facilities, transportation systems, traffic density, utilities (sewer and water), fire stations, hospitals and soil productivity.

Other data, such as population trends, industrial production, employment, climate, et cetera can be shown by charts or tabulations.

The Basic Planning Studies may very well include a Future Use-of-Land Map showing probability of urban and industrial spread, and the probable changes of other land uses such as those of various forms of agriculture, forestry and recreation. In addition, preliminary county development studies showing the location and character of future public improvements such as roads, parks, airports, public and semi-public transportation facilities and consolidated schools should be prepared.

Based upon analysis of the above factual surveys and preliminary planning studies, a general development plan of the county should be prepared. The County Planning Commission will then adopt this as its guide plan and submit it to the County Commissioners as the Planning Commission's general recommendation. If the Commission has been given zoning authority, a zoning ordinance and map should be prepared by it under procedures outlined in Chapter III.

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Once the County Plan has been formulated and given concrete expression in the legislation of a zoning act and other regulatory measures, it becomes necessary constantly to promote active public interest in continuous planned improvement.

The County Planning Commission should:

1. Publicize the plan and the planning idea by printed reports, newspaper articles, and public addresses, and by placing plan and reports in the hands of local public administrators and in the public schools.
2. Advise local administrations within the jurisdiction of the County Commissioners of the county planning operation and request copies of local plans when and as prepared.
3. Make recommendations to the County Commissioners with respect to individual improvement projects, upon request of the County Commissioners, or upon the initiative of the Planning Commission.
4. Make recommendations with respect to individual *local* improvement projects of major concern, upon request of local municipal officials, or upon initiative of the Planning Commission.
5. Prepare a long-term program of public works for the county. This program should be revised each year and publicized.
6. Consult with the State Planning Board and the county solicitor, whenever in doubt concerning the powers of the county planning commission and the proper methods of procedure.
7. Make recommendations to the proper State departments as to needed highway, park, or institutional developments, study the effect of all proposed State public works on the county's welfare, and suggest such changes as may be locally necessary or desirable.
8. Wherever a county urban redevelopment authority has been appointed, the planning commission must designate areas needing redevelopment, and supply plans and recommendations for the rehabilitation of such areas.
9. Review and report upon land subdivision plats referred to the County Planning Commission by the localities in accordance with the County Planning Act, and approve or disapprove all other plats of subdivisions within the County. Prior to exercising its land-platting control authority, prepare and adopt platting rules and regulations. These rules and regulations are needed for guidance of both land subdividers and the Planning Commission and should include: Procedures to be followed in submitting plat maps, minimum platting standards

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to be required, and general conditions required for plat map approval.

10. Continue with the general planning studies with a view to further development and adjustment of the county plan as changing circumstances may require. This is especially important since all contingencies cannot be foreseen at the time of making a county plan. An unchangeable plan quickly becomes a dead plan.

11. Study and report upon all proposed amendments to the zoning ordinance and map. This procedure should be specified in the zoning ordinance.

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Chapter III

COUNTY ZONING PROCEDURES

(Under Act No. 435, Laws of 1937)

County zoning is properly an integral part of county planning and gives best results when done as a part of the comprehensive planning job. Its purpose is to safeguard and assist in the carrying out of the county plan; to protect and improve land values; to insure orderly and economical development; and to safeguard and advance the health and general well-being of the people.

Intimate Dependency of Zoning on Planning

It is possible, under Act 435, Laws of 1937, to proceed with county zoning without county planning but usually it is better not to do so. County zoning is a serious undertaking, highly beneficial if done well but equally detrimental if done superficially and unwisely. Good county zoning requires almost as extensive basic mapping, surveys, and development studies as have been outlined for county planning. Therefore, there is little economy in trying to do the zoning job alone.

In recognition of the importance of comprehensive planning to safe and effective county zoning, the Legislature has provided, in the County Planning Act, that a county planning commission may, if the County Commissioners so desire, serve also as a county zoning commission with all the powers conferred by the County Zoning Act, the operation of which is discussed below. Giving the county planning commission this dual responsibility, where both planning and zoning are to be done, has the additional advantage of insuring perfect coordination of these two closely related undertakings and of preventing the confusion and overlapping of work unavoidable when two such closely related commissions are at work in the same county at the same time.

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PROGRAM FOR ESTABLISHING COUNTY ZONING ORDINANCES IN PENNSYLVANIA

The Board of County Commissioners appoints a zoning commission, or a planning commission with authority to serve as a zoning commission.

The zoning commission, after making preliminary studies and surveys, prepares a tentative zoning ordinance and map, and submits it to the State Planning Board for review and report.

The zoning commission holds public hearings on the ordinance, prepares the final report and submits it to the county commissioners.

The county commissioners hold the required public hearings, refer any revisions to the zoning commission, and subsequently enact the zoning plan and ordinance.

The zoning commission prepares a list of all non-conforming uses immediately following enactment of the zoning ordinance by the county commissioners.

Certified copies of all existing and all new zoning ordinances and amendments must be filed with the county Recorder of Deeds by each political subdivision.

The county commissioners, upon enactment of the zoning ordinance, appoint a zoning board of adjustment to consider appeals for exceptions and variances, and a zoning officer to administer the zoning ordinance.

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Authorization for County Zoning

Under The County Zoning Act, all counties of Pennsylvania, 2nd to 8th classes, are empowered, "to enact zoning ordinances and resolutions providing for the zoning and regulation of the location, height, bulk, and use of buildings and other structures and of the uses of land, and the requirement of building permits,—in the portion of counties lying outside of cities, boroughs, and townships of the first class" and by this means to "regulate . . . the location, height, bulk, and size of buildings and other structures; the percentage of lot which may be occupied; the size of yards, courts, and other open spaces; the density and distribution of population; the uses of buildings and structures for trade, industry, residence, recreation, public activities, and other purposes; and the uses of land for trade, industry, residence, recreation, agriculture, water supply conservation, soil conservation, and other purposes."

The operation of this Act* is briefly as follows:

Personnel & Eligibility for Zoning Commission Prescribed

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In order to avail itself for this authority, the Board of County Commissioners shall invest its Planning Commission, if such exists, with the zoning function, or appoint a zoning commission of three, five, or seven members, the majority of whom shall not hold elective public office. Thus, the Board of County Commissioners has the choice of (a) creating a zoning commission or (b) appointing a county planning commission with zoning powers or (c) conferring the additional authority of serving as a zoning commission upon an existing county planning commission. If a county planning commission is to serve as a zoning commission, then its appointment and its personnel are as provided by the County Planning Act and not as provided by the County Zoning Act for zoning commissions.

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Joint Zoning Commissions

Two or more counties may combine to appoint a single zoning commission. This possibility is

*Full text of Act given in Appendix.

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discussed in Chapter V dealing with joint or regional planning and zoning procedures.

Remuneration and Duties of Zoning Personnel

The zoning commission shall be unpaid but may be reimbursed for necessary expenses incident to performance of duties.

It shall be the duty of the county zoning commission, promptly upon appointment, to proceed with making a zoning plan for the area within its jurisdiction, including a zoning map and ordinance for certification to the Board of County Commissioners and representing the zoning recommendations of the zoning commission.

In proceeding with its zoning studies, the zoning commission is directed to make use of all pertinent information available in, and all assistance that may be supplied by federal and state officials, departments, and agencies, especially the State Planning Board. In fulfillment of its duties, the zoning commission is authorized to employ trained personnel and other assistance to whatever extent permitted by funds made available by the County Commissioners.

Nature of County Zoning Problem and Its Definition in Terms of Local Needs and Circumstances

The needs for and application of zoning will vary widely for the individual counties of this State. For the more urban counties, especially those within or closely adjoining metropolitan areas, county zoning will be concerned in large part with problems almost identical with those of city or urban zoning. Emphasis in such counties will, by necessity, be placed upon regulating the location and extent of industrial and business structures, the density of population, and the open spaces surrounding residential structures. For rural counties, chief concern will be with the proper use of lands and a distribution and concentration of population conducive to the rendering of good public services at reasonable cost, particularly with respect to roads and schools. In many rural counties of this State, there are large areas unsuited to agricultural use. Farming in these areas is a hazardous undertaking, seldom providing for a decent stand-

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ard of living. Scattered farm occupants can be provided with schools and roads only at excessive cost to the counties and the State. Zoning in such rural counties will be concerned with prevention of further agricultural settlement of poor farm areas and with the gradual restoration of these areas to more profitable use such as timber growing and recreation. Common to virtually all counties of the State will be the problem of regulating the development of frontage upon much-traveled highways subject to the encroachment of miscellaneous business structures and billboards, all tending to destroy the beauty and usefulness of the highways and to increase traffic hazards.

Zoning should be undertaken with a view to the peculiar problems and individuality of the county concerned and the zoning ordinance and map of each locality should be skillfully fitted to local conditions and needs. There are a number of more or less standard clauses,—especially as to such items as definitions and administration,—that will be found uniformly applicable in all county zoning ordinances. But those parts of the ordinance that set forth the kind and degree of regulations to apply to a particular county or part of county should be "custom made" and drawn to meet local needs. These may be quite different from those of even neighboring counties. It follows that "model" county zoning ordinances are not feasible and that extensive copying of ordinances of other counties is not good practice. It should be borne in mind that the zoning map,—that instrument which defines the boundaries of the several areas in which various regulations are to apply,—is in the last analysis, even more important than the text of the ordinance and requires even more recognition of the local situation and its needs.

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Zoning Ordinance Made Up of Ordinance Text and Zoning Map

Of the two parts to a zoning ordinance,—the ordinance text and the zoning map,—the ordinance text sets forth the number and names of zones or districts to be created; tells just what uses shall be

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permitted and what regulations shall apply in each district; indicates how the ordinance shall be administered and amended, together with procedure for handling appeals from rigid enforcement of the ordinance. The zoning map is a county map upon which are shown the various zones or districts, with clear indication of district boundaries. The zoning map is, itself, a part of the zoning ordinance.

Special Provisions of the Enabling Act; Board of Adjustment, etc.

Among the provisions of the State Enabling Act for county zoning are:

1. There may be as many kinds of districts as may be necessary to meet the needs of a locality but the regulations for each kind of district must be uniform throughout.

2. Uses and structures contrary to the regulations of the district in which they occur, existing at the time of enactment of the zoning ordinance, shall be allowed to remain as "nonconforming" uses or structures, with regulation as to conditions of continuance and as to amount of allowable extension. (See Section 510.14 of the Act for more complete information.)

3. The ordinance and map may be amended by the Board of County Commissioners at any time by following procedures as have been described for original enactment of the ordinance.

4. The Board of County Commissioners shall appoint a Board of Adjustment of from three to five members who shall assist in administration of the ordinance and shall have the power to grant appeals from the literal application of the ordinance, within limits prescribed by the Enabling Act and included in the county zoning ordinance. Operation and powers of the Board of Adjustment are discussed below in greater detail.

Number and Kind of Districts

The number and kind of zones or districts to be created will vary with every county according to the present and probable character and range of activities and of development within the county concerned. Number of districts should be held to the minimum essential to local purposes. For counties partly urban and partly rural, the following kinds of districts may be found desirable; a heavy and a light industrial district; a central and a neighborhood business district; one, two or three

kinds of residential districts; an agricultural district; and, possibly, a forest-recreation district. For rural counties, relatively free of urban conditions and industrial development, the required kinds of districts probably will not exceed: one industrial, one business, one residential, one agricultural, one recreational and one forest.

For counties of widespread and intensive agricultural development, there may be no need for a forest-recreational classification. Likewise, such a district classification may not be applicable to the more urban counties. Forest-recreation district, usually, will be closed to all-year-round residential uses, thereby removing the costly necessity of providing schools and all-year-round roads for scattered inhabitants.

This is not to suggest that there is to be only one area set aside for each of these various use-districts. It refers to *kinds* of districts only. There may be dozens of areas scattered throughout the county, falling within each kind of district.

Procedure in Preparation of the Zoning Plan and Ordinance

First of all, in the preparation of zoning plan and ordinance there are a few general principles to be observed:

1. Zoning must be *reasonable.*

2. Regulations should be as elastic as is consistent with accomplishment of their intended purposes. Care should be taken to assure that good new forms of development and experimentation are not discouraged or prohibited in the effort to prevent bad and unwise development.

3. The location, extent, and nature of zoning districts should be guided largely by existing conditions, but determined with due regard for future probabilities and possibilities and with a view to gradual improvement of undesirable existing development.

4. The zoning job should be approached with technical skill and with a knowledge of the zoning experience of other communities and of the current attitude of the courts with respect to various applications of the zoning power. Unwise zoning and over-extension of the zoning power will do more than anything else to destroy the effectiveness of zoning.

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5. Most common and most serious failing of zoning undertakings is that of placing too much land in business and industrial districts, thereby sterilizing for residential development and investment land which never may be needed or be saleable for commercial use. Greatest danger here for rural counties will be in the zoning of highway frontage. Better under-zone than over-zone for business and industry. It is easy to amend a zoning ordinance downward but difficult to change from a lower to a higher restricted district.

Content of Studies, Surveys and Maps

Good zoning requires about the same kind of basic information and preliminary study as is necessary to good county planning. The county zoning work-program, therefore, should include the acquisition or preparation of many of the same base maps and the making of most of the same factual surveys as listed for county planning in the foregoing chapter.

Specifically for county zoning there is needed, in addition, an "Existing-Use" Map made by field survey and made most satisfactorily and most efficiently by use of an air map. In considerable part, the air map is itself an "Existing-Use" Map needing only closer identification of buildings and land-uses than can be read directly from the map.

Upon completion of the mapping and survey program, county planning studies should be extended at least to the point of determining a present and future main-thoroughfare system and areas likely to be needed and ultimately to be used for various public purposes, including parks, playgrounds, and public building sites, and areas probably to be used for various private purposes including residence, industry and agriculture.

Upon accumulation and analysis of the above information, the zoning commission (or planning commission serving as a zoning commission) and its technical assistants and advisors may proceed to block out the various zoning districts and to draft the tentative county zoning ordinance.

Before submitting its recommended zoning ordinance and map to the Board of County Commissioners, the zoning commission shall hold at least

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one public hearing. Notice of such hearing or hearings shall be published in a newspaper of general circulation in the county at least 15 days before the date of hearing.

Procedure in Adoption of the Zoning Ordinance; Public Hearings, Tentative and Final Drafts and State Planning Board Review

While the Enabling Act does not specify that this publication of notice shall include the full text of the ordinance and the map, it is advisable that this be done or that some other means be employed to give general circularization of the proposed ordinance among the citizens and property owners of the county. For most, and perhaps all, counties more than one public hearing, arranged for convenience of location, will be found desirable.

In addition to holding public hearings and prior to making its final report, the zoning commission shall submit the tentative draft of zoning ordinance and map to the State Planning Board for review and report, which Board shall return its report within 45 days of date of submission.

Following the public hearings and after receiving the report and advice from the State Planning Board, the zoning commission should make its final revisions of ordinance and map and submit the certified final drafts promptly to the Board of County Commissioners with recommendation for adoption.

Upon receipt of the certified draft of the recommended zoning ordinance and map from the zoning commission, the Board of County Commissioners may proceed to adopt the Zoning Ordinance.

In the process of adoption, however, the Board of County Commissioners shall, in turn, hold a public hearing duly advertised at least thirty days in advance of the hearing date.

The Board of County Commissioners may make changes in the certified ordinance and map only after first submitting such proposed change to the zoning commission for report and advice thereon. But disapproval of such change by the zoning commission does not stop its adoption by the County

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Commissioners; for final legislative power rests entirely with them.

Amendment

The Board of County Commissioners may amend either the zoning ordinance or the zoning map at any time, following the same procedure as for adoption of the original ordinance: (a) submission of proposed amendment to the county zoning commission for report; (b) submission of the proposed amendments to the State Planning Board for report and advice; and (c) the holding of a public hearing after due notice.

A certified copy of the zoning ordinance and all amendments thereto must be filed with the County Recorder of Deeds before the ordinance becomes effective. Copies of all existing zoning ordinances must also be filed within six months beginning May 14, 1949, under Act No. 400, session of 1949 of the General Assembly.

Administration of County Zoning; Zoning Officer, Permits, etc.

Routine administration of the zoning ordinance, including general interpretation of the ordinance, issuance of permits, and inspections, should be assigned to a special county officer to be known as the "zoning officer." The zoning officer has no discretion in the matter of issuing permits. If the building or use in question conforms to the zoning ordinance, he must issue a permit. If the building or use does not conform to the ordinance, the zoning officer must refuse a permit and advise as to procedure in taking an appeal to the board of adjustment.

As a means to administering the zoning ordinance, building or use permits should be required for all new or remodeled structures and for all land uses coming within the province of the zoning ordinance as drawn. As a check upon conformance to conditions set forth in the building permit, it may be found desirable to require issuance of occupancy permits prior to occupation of completed structures. In order to avoid unnecessary "red tape" in the requirement of permits, certain buildings and certain land uses such as farm buildings

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and farm lands may be exempted from this requirement.

Administrative Costs; Fees

The nominal fees charged for permits should, in most cases, be sufficient to meet all normal administrative costs including compensation to the zoning officer.

Board of Adjustment; Composition, Powers and Duties

For special interpretation of the ordinance and for the hearing of and action upon appeals from the literal application of the ordinance, the Board of County Commissioners shall create a board of adjustment of from three to five members not more than half of whom shall also be members of the zoning commission.

Powers and duties of the board of adjustment are set forth in the Enabling Act. They include:

1. Authority to make certain special exceptions, which must be stated specifically in the zoning ordinance.

2. The duty of interpreting the ordinance and map in case of dispute.

3. Where, by reason of exceptional narrowness, shallowness, or shape of a specific piece of property at the time of the enactment of the regulation or, by reason of exceptional topographical conditions or other extraordinary and exceptional situation or condition or such piece of property, the strict application of any regulation enacted under the Enabling Act would result in peculiar and exceptional practical difficulties to or exceptional and undue hardship upon the owner of such property, to authorize upon an appeal relating to said property, a variance from such strict application so as to relieve such difficulties or hardship provided such relief may be granted without substantial detriment to the public good and without substantially impairing the intent and purpose of the zone plan and zoning ordinance.

The board of adjustment is a necessary part of workable zoning machinery since it is impossible to foresee and provide for all contingencies and for all situations in any general ordinance. But a board of adjustment must proceed with judgment and caution and without stretching the discretionary powers conferred upon it by the State Enabling Act if it is not to defeat the purpose of zoning.

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A grievance with any decision of the board of adjustment may be taken by any person to the County Court of Common Pleas.

Further Duties of the County Zoning Commission; Listing of Non-Conforming Uses, etc.

It will seldom happen that a good zoning job can be done without including a few existing uses in districts where these uses are prohibited. Such existing out-of-place uses or buildings are known technically as "non-conforming" uses.

Immediately upon adoption of the Zoning Ordinance by the Board of County Commissioners, as an aid in administration of the Ordinance, the zoning commission shall prepare and publish a complete list of non-conforming buildings and uses, giving descriptions, locations, and names of owners. This list shall be corrected annually.

Thereafter the duties of the county zoning commission, or of the county planning commission with respect to zoning, are limited to consideration of proposed zoning amendments or the initiation of amendment recommendations.*

* The above is largely by way of interpretation of the Zoning Enabling Act and its effective operation. The full text of the Act, as contained in the Appendix, should be referred to in taking any definite action toward the creation of a county zoning commission or toward the making and adoption of a county zoning ordinance. For sources of more detailed information as to county zoning principles and procedures, see the Bibliography in the Appendix. A number of zoning principles and procedures, discussed in greater detail in Chapter IV, "Zoning for Townships of the Second Class," are equally applicable to county zoning.

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Chapter IV

ZONING PROCEDURES FOR TOWNSHIPS OF THE SECOND CLASS

Power to zone was granted to townships of the second class by Act No. 504 of 1937, P. L. 2624, as amended in 1943 and in the Second Class Township Code of 1947.

The township zoning law supplements the county zoning law by enabling individual rural, or semi-rural, townships to provide themselves with zoning protection, if no county zoning ordinance has been adopted.

The powers discussed in this chapter cannot be exercised if a county zoning ordinance exists, or if taxpayers, whose property valuation within a township amounts to fifty-one percent or more of the total property value within the township or within a district defined under a zoning ordinance, shall sign and file in the office of the prothonotary of the county a written protest against the exercise of such township powers.

The Zoning Law for Townships of the Second Class grants these powers to the township supervisors:

"the supervisors may divide the township into districts of such number, shape and area as may be deemed best suited to carry out the purpose of this article, and within such districts, it may regulate and restrict the erection, construction, reconstruction, alteration, repair or use of buildings, structures or land. All such regulations shall be uniform for each class or kind of buildings throughout each district, but the regulations in one district may differ from those in another district."

The character and purpose of such regulations is declared to be that they

"shall be made pursuant to the powers granted in this article in accordance with a comprehensive plan and designed to lessen congestion in the roads and highways; to secure safety from fire, panic and other dangers; to promote health and the general welfare; to provide adequate light and air; to prevent the overcrowding of land;

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PROGRAM FOR ESTABLISHING ZONING IN TOWNSHIPS OF THE SECOND CLASS IN PENNSYLVANIA

The Board of Township Supervisors appoints a zoning commission and makes the necessary appropriations for the zoning program.

The zoning commission, after making preliminary studies and surveys, prepares a tentative zoning plan and ordinance.

The zoning commission holds public hearings on the ordinance, prepares the final report and submits it to the township supervisors.

The township supervisors hold the required public hearing,* refer any revisions to the zoning commission, and subsequently enact the zoning plan and ordinance.

Certified copies of all existing and all new zoning ordinances and amendments must be filed with the county Recorder of Deeds by each political subdivision.

The township supervisors, upon enactment of the ordinance, appoint a zoning board of adjustment to consider appeals for exceptions and variances, and a zoning officer (who may be the township engineer) to administer the zoning ordinance.

* The ordinance may be advertised by reference.

to avoid undue congestion of population; to facilitate the adequate provision of transportation, water, sewerage, schools, parks and other public requirements. Such regulations shall be made with reasonable consideration, among other things, to the character of the district and its peculiar suitability for particular uses, and with a view to conserving the value of buildings and encouraging the most appropriate use of land throughout such municipality."

It is strongly recommended that zoning be undertaken, not separately, but as a part of comprehensive planning. Such procedure is urged because the probable future layout of roads and other transportation facilities, and of parks, school grounds, and other public and semi-public service facilities has large bearing upon where business, industrial, residential, and other kinds of uses should be prohibited or encouraged.

While no specific legislation for comprehensive planning for these townships exists, what amounts to comprehensive township planning is both permissible and desirable as a part of the zoning job. Furthermore, the Township Zoning Enabling Act, implied that such procedure shall be followed in the section quoted above, where it states that, *"such regulations shall be made in accordance with a comprehensive plan,"* and goes on to list the several things which are to be taken into account, many of which require comprehensive planning for their intelligent consideration.

In few instances will all the previously specified purposes of zoning be important to one township. Zoning may be advanced to achieve any one of them and may be well worth doing even for so limited an objective. For instance, a rural township may suffer no growing pains except those occasioned by the cumulative cluttering up of State highways extending through township territory. It may be worth while to enact a zoning ordinance simply to keep billboards, gasoline stations, roadside restaurants, and other such commercial structures in their proper locations.

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For rural townships within or adjoining suburban territory, however, there may be many more zoning purposes to be sought than may at first appear. Such township territory, usually, is subject to many forms of speculative and sudden development. It represents the city in its embryonic stage when regulation to insure orderly and healthful development is most important and easiest to apply. Broader need for zoning will be found also in rural townships with high degree of "estate," or recreation, or non-farm use, where orderly development is important to protect a township's chief asset,—attractive rural environment.

Preparatory Procedure in Making Zoning Plan and Ordinance

In order to avail themselves of their zoning powers, the township supervisors must appoint a zoning commission of five citizens whose duty it shall be to formulate a zoning ordinance and to prepare a zoning map for consideration and ultimate adoption by the township supervisors. The township supervisors may not themselves prepare the zoning ordinance and map.

In some instances the township supervisors will initiate zoning and the appointment of a zoning commission. Usually, however, they will await some expression of desire for zoning upon the part of property owners. The actual first step in going about zoning a township, therefore, will very likely be the petition by property owners to the township supervisors that a zoning commission be appointed rather than the appointment of such a commission.

It is the duty of the zoning commission, whenever one is appointed, to proceed with the making of a zoning map dividing the township into the proper number and kind of use-districts and to draft a zoning ordinance setting forth the regulations which shall govern each district and the manner of administration of these regulations.

In drafting both ordinance and map, it should be appreciated from the start that every township has it own peculiar needs and problems and that the zoning ordinance for one township may not be

at all applicable to another. Copying an ordinance designed for one township for application in another township, therefore, is not a safe procedure and may do more harm than good. It should be borne in mind also that the way the various districts are laid out on the zoning map, prescribing what uses are permitted in one area and prohibited in another, is oftentimes more important to reasonable and effective zoning than is the phraseology of the text of the zoning ordinance.

Mapping

The first step of the Zoning Commission should be to ascertain, tabulate, and map all pertinent facts as to existing conditions throughout the township territory and immediately adjoining area. Much of this factual data can best be shown on maps. One map should show all public and semi-public properties including: streets and roads, parks and playgrounds, school and other public building grounds, airports, railroads, navigable waterways and the like; together with such geographical features as lakes and principal streams. Another map should show the existing use of private property whether for one or another kind of business or industry, residence (single or multiple family dwellings), and active agriculture or forest. For simplification, the indication of such uses may be grouped in rather broad classifications with individual definition of only such uses as are likely to be made subject to special regulations. For instance, in areas occupied by general business, special designation need be made only for such things as gasoline stations, garages, and factories; and for residential uses only multiple family dwellings need be singled out for special designation on the map.

Air photographs, now to be obtained at comparatively small cost, are the best sources of existing use-of-land and much other needed planning information. They more than pay for themselves in time saved and mistakes avoided. Where no good township map exists, by far the best and cheapest

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way of making one is by compiling it from an air photograph, at whatever may be the desired scale.

Need for Population Statistics

In addition to the information outlined above, there should be compiled and tabulated or mapped such data as the widths of streets and roads, the area of public properties, the amount and distribution of population and the past rate and character of population growth, the kind of local industries and the amount and kind of employment afforded by them, and other similar data of local significance to improvements needed or likely to be needed and to the nature of the probable future development of the territory under study.

Armed with the necessary maps and factual data, the Zoning Commission should proceed with its comprehensive planning studies and then, upon the basis of these studies, to lay out the several use districts on the township map and to draft the township zoning ordinance. The tentative community plan accompanied by the planning studies, resulting in the formulation of the general township plan, should be held and further developed by the Commission and by the Township Supervisors as a guide for laying out and programming future public improvements.

Number and Kinds of Districts as Defined by Use

The zoning ordinance and map should apply to the entire area of the township.

The number of kinds of districts should be made as few as is consistent with desired results. For the average rural or semi-rural township the following kinds of districts or zones should be sufficient: one residential, in which all usual agricultural as well as residential uses are permitted (occasionally it may be desirable to provide a second residential district in which multiple family dwellings are permitted or to set certain agricultural uses off in a special district); one business; and one industrial (in an area subject to the intrusion of heavy or obnoxious industries it may be necessary to provide a second industrial classification to isolate such uses). In some townships it may be

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desirable to regulate the use of strictly rural lands and therefore add such districts as agricultural, and forest-recreational, in which cases the determinations with respect to such districts will be much the same as for county zoning.

Definition of "District" as Used Outside Urban Areas

This is not to suggest that there is to be only one area set aside for each of these various use-districts. It refers to *kinds* of districts only. There may be several areas scattered throughout the township, falling within each kind of district.

Provisions should be made whereby certain special uses such as public institutions, hotels, clubs, and public utility buildings are allowed in any district, subject to compliance with specified conditions to be set forth in the ordinance and to be adjudged by the Board of Adjustment.

Districting Specifications in Zoning

The ordinance should be extended beyond the mere regulation of location of structures and uses to provide for proper open space at the front, sides, and rears of buildings and to provide for building lines along the frontage of all streets, roads and other thoroughfares. Side yards and rear yards, especially, should be sufficient to insure access of ample light and air to dwellings and to safeguard against spread of fire. Building lines or building set-back lines along thoroughfares should be established with a view to keeping buildings well back from traveled ways and should be placed at a distance back from the roadway in proportion to the volume and objectionable character of traffic upon the road or street in question. In rural areas, business buildings usually should be held back to the same line as established for residential structures.

Billboards and large advertising signs should be confined to business and industrial districts, possibly subject to special restrictions even in these districts. The commission is authorized to consult with the State Planning Board in the preparation of its report.

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Procedure in Enactment of Zoning Ordinance

Further procedure toward enactment of the zoning ordinance is as follows: Having prepared its initial draft of the zoning ordinance and map the zoning commission is required by law to submit a preliminary report to the township supervisors and to hold public hearings at which all citizens are given opportunity to be heard as to their views concerning either the zoning ordinance as a whole or as to its application to individual properties.

Following such public hearings the commission may make such revisions of its tentative ordinance and map as may seem advisable and submit its final report and recommendation to the township supervisors. Such final report and recommendations may consist of the suggested zoning ordinance and map, together with a letter of transmittal advising of the several steps taken and completed by the zoning commission in accordance with the provisions of the zoning enabling act.

Prior to enactment of the zoning ordinance and map, as prepared and recommended by the zoning commission, the township supervisors must proceed in turn to hold a further public hearing at which all parties in interest shall be given opportunity to be heard. It is required by law that fifteen days' notice of this hearing shall be given by publication in an official paper or a paper of general circulation in the township.

Following this public hearing, the township supervisors may proceed with the enactment of the zoning ordinance in the same manner as for other enactments, except that the provisions of the ordinance need not be advertised or recorded as in other cases, but may be supplied by reference to a typed or printed copy of the provisions of the Code.

Copies of the zoning ordinance, thus adopted by reference, shall be made available to any interested party at the cost thereof, or may be furnished or loaned without charge, and a copy of such provisions shall be attached to the ordinance book with the same force as if duly recorded therein.

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A certified copy of the zoning ordinance and all amendments thereto must be filed with the County Recorder of Deeds before the ordinance becomes effective. The copies of all existing zoning ordinances must also be filed within 6 months beginning May 14, 1949, under Act No. 400, session of 1949 of the General Assembly.

Need for Experienced Assistance

The above is not a complete treatise on the technique of planning and zoning. Rather, it is intended as an outline statement of principles to be observed and general procedures to be followed. Planning and zoning comprise as distinct an art and science as the professions of law, engineering, and architecture and are no more susceptible than are these other activities to rule-of-thumb procedures that can be set down in a few words in a document of this sort. Wherever at all possible, townships engaged in zoning and planning will do well to employ, or otherwise obtain, experienced assistance for this work.

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Handling of Non-Conforming Uses

Although the zoning commission is directed to take existing conditions reasonably into account when establishing the location and boundaries of the several zoning districts, it will seldom happen that a good zoning job can be done without including a few existing uses in districts where these uses are to be prohibited. Such existing out-of-place uses or buildings are known technically as "non-conforming" uses. In the absence of specific instructions in the Enabling Act as to how non-conforming uses are to be handled by a township zoning ordinance it may be assumed that general practice is to be followed. That is: non-conforming uses are allowed to remain under certain restrictions to be set forth in the zoning ordinance, as to the extent to which they may be enlarged (possibly a maximum of 25 percent of cubic contents) and as to their discontinuance following a specified period of abandonment as to be defined in the ordinance.

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Method of Amending the Zoning Ordinance and Map

Either the zoning ordinance or the zoning map or both may be amended by the township supervisors at any time by following the same procedure as in the enactment of the original ordinance. Except that

"in case of a protest against such change signed by the owner of twenty percent or more either of the area of the lots included in such proposed change or of those immediately adjacent in the rear thereof extending one hundred feet therefrom or of those directly opposite thereto extending one hundred feet from the street frontage of such opposite lots, such amendment shall not become effective except by the favorable vote of all the township supervisors."

Much caution should be exercised in making changes in the ordinance and map. Too frequent and too spotty changes may quickly destroy or severely weaken the whole operation of zoning. Map changes should rarely, if ever, be made for individual lots or very small areas.

A good safeguard in the matter of amending the zoning ordinance is provision in the ordinance that all proposed amendments shall be referred to the zoning commission for report, prior to final action by the township supervisors.

Administration; Permits, Zoning Officer, etc.

As a means to administering the zoning ordinance, permits should be required for all new or remodeled structures and for all land uses coming within the province of the zoning ordinance as drawn. As a check upon conformance to conditions set forth in the building permit, it may be found desirable to require issuance of occupancy permits prior to occupation of completed structures. Reasonable fees should be charged for all permits. In order to avoid unnecessary "red tape" in the requirement of permits, certain buildings and certain land uses such as farm buildings and farm lands may be exempted from this requirement.

Some township employee or other person should be designated as the zoning officer and charged with the duty of issuing permits and of checking against ordinance violations. This office should be

created by the zoning ordinance and the officer should be designated as the "Zoning Officer." Where there is a Building Inspector he, usually, is given the additional duty of serving as the zoning officer.

The zoning officer has no discretion in the matter of issuing permits. If the building or use in question conforms to the zoning ordinance, the zoning officer must issue a permit. If the building or use does not conform to the ordinance the zoning officer must refuse a permit and advise the applicant as to steps to be taken for an appeal if he cares to make appeal.

Board of Adjustment; Powers and Responsibilities, Grievances and Court Appeals

The enabling act provides that the township commissioners *may* appoint a board of adjustment of three members. Experience has amply shown that a board of adjustment is always desirable and that it is therefore recommended that such a body be provided for in all township zoning ordinances. The chief function of a board of adjustment is to interpret the zoning ordinance and to grant exceptions to the literal application of the zoning ordinance where, by reason of peculiar conditions, unnecessary hardship will result from strict conformity. A wise board of adjustment can do much to avoid legal controversy and to clear away unnecessary and unreasonable restrictions while still preserving the intent and objective of the zoning ordinance.

By misinterpretation or over-extension of its powers, however, the board of adjustment may completely nullify the effect of a zoning ordinance through too liberal granting of exceptions. It is well therefore to set forth clearly in the zoning ordinance exactly the powers and duties of this body.

A too common weakness of boards of adjustment is to grant use-exceptions without any very special surrounding conditions. In most cases of use-exceptions, if the granting of such exceptions is warranted, the zoning map is wrong. Procedure,

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then, should not be the granting of an exception by the board of adjustment but amendment of the zoning map, by the township supervisors. Action of the board of adjustment in such cases should be limited to that of recommending a map change.

The enabling act provides that the board of adjustment shall have the following powers:

(1) "To hear and decide appeals where it is alleged there is error in any order, requirement, decision, or determination made by an administrative official in the enforcement of this act or of any ordinance adopted pursuant thereto.

(2) "To hear and decide special exceptions to the terms of the ordinance upon which such board is required to pass under such ordinance.

(3) "To authorize upon appeal in special cases such variance from the terms of the ordinance as will not be contrary to the public interest where, owing to special conditions, a literal enforcement of the provisions of the ordinance will result in unnecessary hardship and so that the spirit of the ordinance shall be observed and substantial justice done."

Any person aggrieved by the Zoning Ordinance, its interpretation or its administration, may take his case to the court of common pleas but must first exhaust the remedy provided by the enabling act and by the Zoning Ordinance, that of appealing to the Board of Adjustment.*

*For many of the details as to procedure it will be necessary to refer to the text of the Second Class Township Zoning Act. The full text of this Act is contained in the Appendix.

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Chapter V

REGIONAL PLANNING PROCEDURES

Two or more adjoining municipalities may now unite through joint agreement in the performance of their respective governmental powers, duties and functions. This covers a wide range of activities and may include such items as water supply, recreational programs, sewage disposal, public health activities, and the functions of planning and zoning. The legislation for this regional approach is contained in two acts of the General Assembly —the County Planning Law of 1937 and Act No. 159 of 1943, as twice amended in 1945. It authorizes such municipalities to contract for professional services as well as property and materials, and to allocate costs and expenses for carrying out their cooperative duties.

Purpose and Advantage of Joint or Regional Planning

In the field of planning and zoning, the purpose of the regional planning provision is to permit the creation of planning boards with a jurisdiction coterminous with actual planning problems. Only in rare instances is there any logic in the location of established county and municipal boundary lines. Community interests and community development frequently break over these lines. So do important planning problems. Wherever this happens to any large extent there are likely to be important advantages and economies in having one planning commission instead of two or three or a dozen at work.

Rural counties with extensive submarginal land-use problems, may find particular advantage in combining forces in planning and zoning as will also groups of urban municipalities, without definite physical demarcations between them. Consolidation of the planning functions of two or more closely related counties or municipalities, also will

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give many of the benefits usually sought through political annexations or consolidations. Where political annexation or consolidation is the recognized ultimate solution, but difficult of immediate accomplishment, planning on a regional basis may pave the way to the more complete governmental unity by developing the habit of cooperative action between municipalities.

Powers and Duties of Regional Commissions

Under joint or regional planning procedure, the participating governmental units retain all their independent legislative functions. The regional planning commission makes a master plan for all territory under its jurisdiction. It regulates land subdivision activities for the entire area. It maintains the integrity of the plan by means of all the powers conferred by the planning enabling acts upon individual municipal and county planning commissions. It may be authorized to prepare a zoning ordinance and plan for the entire area. But adoption of their respective portions of the regional zoning ordinance and plan rests with the legislative bodies of the individual component political units, in independent action. Zoning administration also remains an individual responsibility, with each governmental agency having its own zoning officer and its own board of adjustment. Powers and duties of the regional planning commissions also may be limited or cut short of those provided by the enabling acts, to whatever degree may be agreed upon by the cooperating governmental agencies. In other words, the regional board may be given any or all the authority conferred upon individual planning commissions.

Personnel and Its Appointment; Joint Planning Organization

"The number and qualifications of the members of any such regional planning commission and their terms and method of appointment or removal shall be such as may be determined and agreed upon by said cooperating authorities and county commissioners provided, however, that a majority of the members of the regional planning commission shall hold no other public office or position excepting appointive membership on a municipal or other planning commission."

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For best workability the regional planning commission should not have more than nine members. However, proper representation from all participating units is more important than keeping the planning body down to most efficient size. If there are several cooperating political subdivisions it probably will be found desirable to increase proportionately the total number of regional planning commission members. Usually, the commission should include representation from each of the participating governmental bodies. Citizen members should be selected for prestige in their respective communities and for good-will and well-informed judgment rather than for possible technical planning skill or experience, for, as in the case of county and municipal planning commissions, the regional planning commission must not be expected to do the actual survey and plan-making job. Its proper function is that of guidance and general direction and of policy making, implemented by adequate funds and technical staff.

ROCEDURES

Compensation and Financing under Joint or Regional Planning

Members of the regional planning commission serve without salary but they may be reimbursed for necessary expenses incurred in the performance of their duties.

Funds for use of the commission may be appropriated by the participating governmental units in whatever proportion and total amount may be agreed upon by them. Within such appropriated funds, the commission may employ whatever staff and technical assistance may be required, and incur other necessary expenses.

Planning and Administrative Procedure

Planning procedures and problems to be encountered are not essentially different for the regional planning commission than for the planning commission of an individual county or municipality. The discussion of planning and zoning procedures in the foregoing chapters, therefore, is equally applicable to regional planning and regional zoning. For regional planning commissions

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serving groups of urban municipalities, however, procedures will be as for city planning commissions rather than as for county planning commissions.

The regional planning commission does have a rather special tactical problem in that it must serve and must deal with several community groups and several governing bodies instead of with one. This problem will vary with each region according to its nature and composition and with the regional objectives. Methods for handling it can best be determined on the ground in each instance and are scarcely subject to general suggestion. The problem is one to be solved largely by tact, well-informed action, good politics, and education.

In defining logical regional planning areas, the State Planning Board is available for assistance to groups of counties or groups of municipalities.

Mapping; Base Maps

The type of maps needed for regional planning will depend upon the characteristics of the region involved. Base maps at scales as large as one inch equals 200 feet should be made for urbanized portions of the region. A scale of one inch equals 2,000 feet would be suitable for rural portions. Mosaics of air photographs and existing use maps at suitable scales are essential. The State Planning Board should be consulted about the types of maps required for any specific region.

Regional Cooperation in Planning

The official regional planning commission represents a rather advanced stage of organization for planning. In many localities, the creation of this official planning body may be difficult of immediate accomplishment. When local planning commissions exist or can be created within such regions, these local commissions can accomplish much toward coordination and unification of plans by unofficial cooperation, including frequent joint meetings. Such unofficial cooperation upon the part of neighboring local planning agencies is strongly urged as a procedure almost certain to be of great mutual benefit.

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Chapter VI

PLANNING AND ZONING INTERRELATIONSHIPS; STATE, COUNTY, AND MUNICIPAL

All units of government in Pennsylvania now have authority to zone and all but townships of the second-class have specific authority to plan and to exercise more or less extensive planning controls. Further, groups of municipalities, groups of counties, and groups of counties and municipalities are authorized to proceed with planning and zoning jointly, under single or joint planning and zoning commissions.

Considerable care has been taken in framing the several enabling acts to avoid conflicting and overlapping functions and jurisdictions. For the most part, there is clear distinction between the powers and duties of the several different kinds of planning agencies.

ROCEDURES

Levels of Public Planning

A natural first question is, why so many different planning commissions? If there is a state planning board, why are county planning commissions needed? If there is a county planning and zoning commission, why should there be need for city, borough, and township planning and zoning commissions? The answer is that for every unit of government charged with rendering public service and with developing the facilities therefor, there is a parallel planning function which, under our system of government, seems best to be performed by some kind of a planning commission. There is little reason for conflict or overlapping if each commission stays within a range of activity corresponding to that of the governmental unit to which it is attached. This is, in large part, provided for by law, but may be further assured by

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self-imposed limitation upon scope of activities, by the planning commission itself. Since planning commissions in Pennsylvania have only advisory powers, except in platting controls, overlapping of planning studies, should they occur, are not especially serious except in that they make for inefficiency and confusion.

Real Estate Platting Control

Subdivision control powers of third-class city planning commissions, in their extension to the territory within three miles of the city limits, do carry some possibility of conflict. The law specifically provides that, in case of an overlapping of the three-mile territory between neighboring municipalities, the jurisdiction of each planning commission shall extend to a point equidistant between the two municipalities. This is clear enough. But the County Planning Enabling Act now confers platting control authority upon county planning commissions for all territory outside of the corporation limits of boroughs and cities. Literal interpretation of the county and the third-class city planning enabling acts specifies that plat maps, for land subdivisions outside of but within three miles of city limits of third-class cities with planning commissions, must be approved by both the county planning commission, if such exists, and by the city planning commission.

Since there are at present relatively few county planning commissions these provisions have caused no serious conflict of authority.

Relation of State Planning Board to Component Governmental Units

In discussing the normal inter-relationships of planning and zoning bodies in Pennsylvania, we shall start with the function of the State Planning Board in its relation to county and municipal planning and zoning commissions.

The State Planning Board is charged with making a comprehensive development plan for the State. This planning includes only major development projects, principally such as are within the jurisdiction of one or another State department, or

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such matters as concern the long-range economy of the State. Such planning will in a sense provide a broad structural framework for the guidance of county and municipal plans.

The State Planning Board has the further legislated function of giving general guidance and assistance to local planning boards and of helping to coordinate local plans. The State Planning Board has no authority or intention of entering either counties or municipalities to make or to impose county or municipal plans of a description falling within the jurisdiction of local planning bodies.

Relation of County to Its Component Governmental Units

The County Zoning Enabling Act provides that all county zoning ordinances shall be submitted to the State Planning Board, for review, prior to adoption. This is to assure that the locality has the benefit of general advice from the State Planning Board but the locality is under no compulsion to accept this advice.

ROCEDURES

County planning commissions, in turn, are charged with the responsibility of making county-wide plans and of assisting city, borough, and township planning undertakings, but have no authority to make local plans. Boroughs and third-class cities may prepare plans for territories within three miles of borough and city limits, an area which is also covered by county plan. Adjustment of conflicting plans within such areas must be by friendly cooperation between the county and local planning boards. In the last analysis, decisions will rest with the authority responsible for the construction and maintenance of whatever projects may be in controversy.

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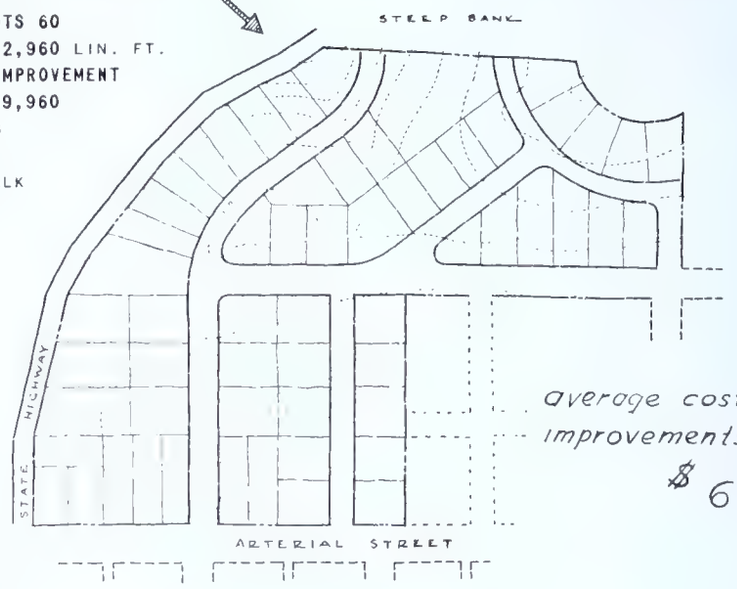
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RECOMMENDED REVISIONS OF A 12 ACRE SUBDIVISION

FOR LOW COST HOUSING – PENNA 1947

A - ORIGINAL PLAN

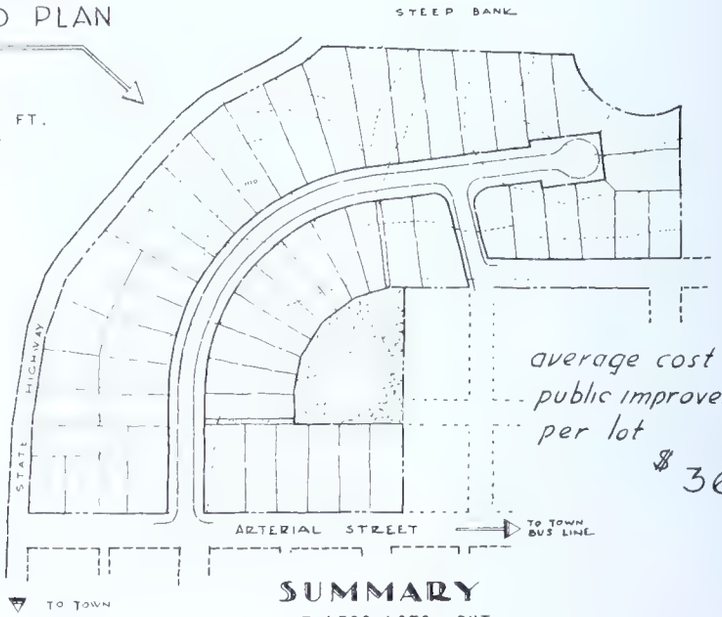
TOTAL LOTS 60
STREETS 2,960 LIN. FT.
PUBLIC IMPROVEMENT
COSTS $39,960
- PAVING
- CURB
- SIDEWALK
- SEWER



average cost for public improvements per lot
$ 666 00

B - REVISED PLAN

TOTAL LOTS 53
STREETS 1,420 LIN. FT.
PUBLIC IMPROVEMENT
COSTS $19,170
- PAVING
- CURB
- SIDEWALK
- SEWER



average cost for public improvements per lot
$ 362 00

SCALE
0 500'

PLAYGROUND OR PUBLIC WALK-WAYS

CONTOUR INTERVAL - 10 FT.

SUMMARY

7 LESS LOTS, BUT
- 1540 FT. (52%) LESS STREET TO CONSTRUCT AND MAINTAIN
- $20,790 SAVING IN PUBLIC IMPROVEMENT
- $304 AVERAGE SAVING PER LOT
- ONE ACRE RESERVED FOR PLAY SPACE
- SIMPLIFIED SCHEME FOR ROADS, SEWER, STORM WATER DRAINAGE AND GRADING

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Chapter VII

EFFICIENCY IN SUBDIVISION LAYOUTS*

The subdivision layouts illustrated on the following pages are examples of typical plans as submitted to municipal authorities for their approval. Revised versions as finally adopted, show what advantages can accrue, both to the developers and to the municipalities, through the proper adaptation of the subdivision layout to the contours of the land and to the requirements for public facilities which must be erected at the cost of the community.

These revisions result in reduced street and public utility extensions, greater convenience to the future residents of the area, reduced traffic hazards, and lower site development costs.

Planning commissions cannot always *require* good subdivision design, but they can accomplish much in this direction by moral suasion and by gradual education of land subdividers and their agents.

ROCEDURES

REVISION OF A TWELVE-ACRE SUBDIVISION

The original plan submitted shows a very complicated street pattern. The revised plan, although lessening the total number of lots from 60 to 53, has a very simple and direct access street which fits the grade in such a way that sewers and surface drainage will be easily handled.

Through sacrificing eight lots in the revised scheme the cost of public improvements per lot has been reduced from $666 to $362, or a net saving of nearly $21,000 on the development. In addition, a small play area has been provided for the residents.

Inasmuch as this particular area was proposed for low-cost housing, it was only through the revision of the plan and the decrease in public improvement costs per lot that it was possible for the developer to proceed.

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* *By Carl W. Wild*

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RECOMMENDED REVISIONS OF A

40 ACRE SUBDIVISION

A-ORIGINAL PLAN

TOTAL LOTS 135
STREETS 7,920 LIN. FT.
PUBLIC IMPROVEMENTS COSTS

PAVING	@ $2.50 SQ.YD.	$61,539
CURB	@ 1.25 LIN.FT.	19,800
SIDEWALK	@ 1.25 LIN.FT.	19,800
SEWER	@ 2.50 LIN.FT.	19,800
TOTAL		**$120,939**

AVERAGE COST PER LOT $895



B-REVISED PLAN

TOTAL LOTS 131
STREETS 5,975 LIN. FT.
PUBLIC IMPROVEMENTS COSTS

PAVING	@ $2.50 SQ.YD.	$43,825
CURB	@ 1.25 LIN.FT.	14,936
SIDEWALK	@ 1.25 LIN.FT.	14,936
SEWER	@ 2.50 LIN.FT.	14,936
TOTAL		**$88,633**

AVERAGE COST PER LOT $676



SUMMARY

4 LESS LOTS - BUT

1,945 FT. (24%) LESS STREET TO CONSTRUCT AND MAINTAIN
$32,306 SAVING IN PUBLIC IMPROVEMENTS
$219 AVERAGE SAVING PER LOT
REDUCE TRAFFIC HAZARDS-NO FULL INTERSECTIONS
MAXIMUM STREET GRADE 9% INSTEAD OF 14%
MORE ATTRACTIVE AND LESS " REGIMENTED " NEIGHBORHOOD
GREATER FEELING OF OPENNESS
MORE SALABLE

SCALE
0 500

EXISTING LARGE TREES

CONTOUR INTERVAL - 10 FT.

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In the plans shown, a definite saving of over $32,000 in public improvements has been achieved, which is of importance, not only to the developer but also to the municipality in terms of less street area to maintain in the future.

In this particular revision consideration was given to the desirability and greater sales value of the lots at the top of the hill-slope shown by the contours. By bringing together the smaller lots on the lower loop of the revised plan so that it would not interfere with the views from the higher and more desirable lots, it was possible to achieve a greater interest and charm in both types of residential development.

Straight streets, superimposed upon this particular hillside location, would be extremely undesirable.

It will be noted, in the original plan, that there are three street intersections at the bottom of the hill, each of which creates a definite traffic hazard. In the revised plan, most of the main traffic is directed to the major highway at the left of the property, thus avoiding, so far as possible, any use of residential streets for fast through-traffic.

The apparent double frontage found on the properties to the left in both plans is created by a steep bank along the main highway. The revised plan applies the basic principle of reducing frontage on major arterial streets, thereby protecting the free flow of through-traffic.

This revision caused a loss of four lots, but resulted in a saving of 24 percent in the street construction, and a reduction of 5 percent in the maximum street grade.

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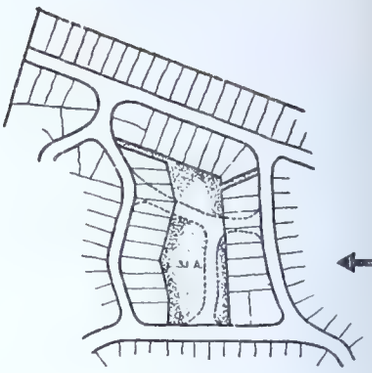
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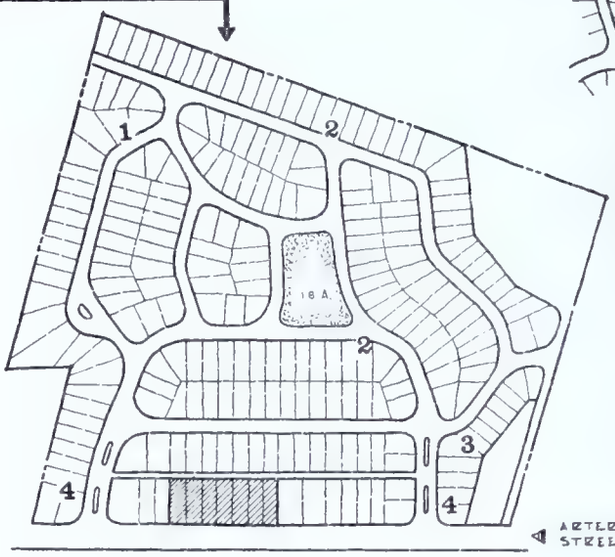
RECOMMENDED REVISIONS OF A

60 ACRE SUBDIVISION

PENNA. 1947



A - ORIGINAL PLAN



B - MINIMUM REVISION

ELIMINATE 925 FT. OF STREET

INCREASE PARK 1.8 A. TO 3.1

REDUCE TRAFFIC HAZARDS AROUND PARK

LOSE ONE LOT, BUT

SAVE $15,000 IN PUBLIC IMPROVEMENTS

C FINAL REVISION

STREETS

1 SIMPLIFIED - PERMITTING A SELF-CONTAINED LOOP FOR INITIAL DEVELOPMENT AND SIMPLER LOT LAY-OUT

2 IMPROVED INTERSECTIONS

3 IMPROVED CURVE

4 ELIMINATE BOULEVARD (COSTLY MAINTENANCE)

PARKS

INCREASED FROM 1.8A. TO 3.1A.

PEDESTRIAN ACCESS TO SHOPPING CENTER THRU PARK

FUTURE GRADE SCHOOL LOCATION ABUTTING PARK

SHOPPING CENTER

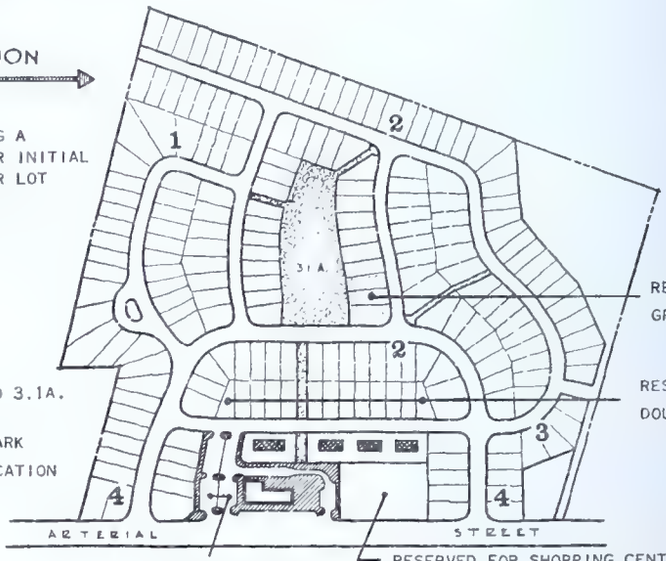
ADEQUATE SET BACK FROM ARTERIAL STREET

ADEQUATE PARKING AND UNLOADING

PROTECTION OF ABUTTING RESIDENTIAL PROPERTIES FROM ENCROACHMENT

PROVISION FOR APARTMENTS USED AS BUFFER BETWEEN COMMERCIAL AND RESIDENTIAL AREAS

EASY AND SAFE ACCESS FROM INTERIOR OF DEVELOPMENT



SCALE

0 300'

SHOPPING CENTER

APARTMENTS

PARK OR PEDESTRIAN WALK-WAY

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REVISION OF A SIXTY-ACRE SUBDIVISION

The original plan, although generally laid out to relieve the monotony of a gridiron pattern, had a number of points which were improved through further study.

The plan as first drawn shows a park of 1.8 acres, surrounded by streets. This is not only too small to be of any practical benefit, but is dangerous and wastes street frontage which might better be devoted to property service.

As will be noted under "B", the entire elimination of the interior lots and redesign as shown, without changing the outer streets, would have increased the park area to 3.1 acres, and would have eliminated nearly 1,000 feet of street with its accompanying ultilities, and reduced the traffic hazard around the park in the original plan. One lot was lost in this layout, but $15,000 in public improvement was saved.

Studying this same layout further, with respect to a potential shopping center which will obviously be needed, it was decided that such a center must be designed with facilities for parking, and that it would be a great mistake to provide a future business area merely by designating certain lots along the main street, as was shown on the original plan.

In the development of this objective, it was found possible to provide a pedestrian walkway to the shopping center from the park area and the interior of the entire development. A buffer-strip between the business area and the single family development has been reserved for double houses and apartments.

It is of interest to note that the plan for this shopping center, with its provision for parking, has within a year and a half led to requests for plots to build a super-market, a theater, a bus station, and a restaurant.

ROCEDURES

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COUNTY PLANNING AND ZONING ENABLING ACT

Excerpts from the General County Law of 1929, as Amended

ARTICLE IV

Section 410. Ordinances and Resolutions.—The board of commissioners may adopt resolutions and ordinances prescribing the manner in which powers of the county shall be carried out and generally regulating the affairs of the county. All such ordinances, unless otherwise provided by law, shall be published at least once in one newspaper of general circulation in the county. Such ordinance shall not become effective until ten days after the publication aforesaid. In any case in which maps, plans or drawings of any kind are adopted as part of an ordinance, the commissioners may, instead of publishing the same as part of the ordinance, refer in publishing the ordinance to the place where such maps, plans or drawings are on file and may be examined.

The board of county commissioners may also prescribe fines and penalties, not exceeding three hundred dollars ($300.00) in any instance, for the violation of county ordinances, which fines and penalties may be collected by suit brought in the name of the county before any justice of the peace in like manner as debts of like amount may be sued for by existing laws.

ROCEDURES

ARTICLE VI

County Planning Commission and Zoning

(a) County Planning Commission (Amended June 25, 1937, P. L. 2124)

Section 501. Creation and Powers of County Planning Commissions.—In counties of the second class, a department is hereby created to be known as the Department of County Planning, which shall be in charge of the county planning commission, and in each other county the county commissioners may create a county planning commission, consisting of nine persons, who shall be residents of the county, four of whom shall be residents of the city or cities therein, and five of whom shall be residents of the boroughs and townships therein, and who shall have knowledge and experience in respect to one or more of the following subjects: finance, commerce, industry, agriculture, transportation, architecture, landscape architecture, real estate, building, engineering, social welfare, civic administration, and law, and at least seven of whom shall not be paid county employes. All of said persons shall be appointed by the county commissioners; three of them shall be designated to serve until the first day of January, of the second year following the year in which they are appointed, three of them until the first day of January, of the fourth year following the year in which they are appointed, and three of them until the first day

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of January, of the sixth year following the year in which they are appointed: Provided, however, That in counties of the second class, the members of the county planning commission in office at the time this amending act becomes effective, shall remain in office until the end of their respective terms. Their successors shall be appointed at the expiration of their respective terms, to serve six years. An appointment to fill a casual vacancy shall be only for the unexpired portion of the term. Three members shall constitute a quorum. They may make and alter rules and regulations for their own organization and procedure, consistent with the resolutions of the county commissioners and the rules of the Commonwealth. They shall serve without compensation, and shall make annually to the county commissioners a report of their transactions and recommendations. They may employ engineers and other persons, whose salaries and wages, and other necessary expenses of the commission shall be provided for, in the discretion of the county commissioners, by proper appropriation and resolution. The county planning commission may be given the additional power and duty of serving as the county zoning commission with all the powers and duties that have been, or may be, conferred upon such county zoning commission by other acts of Assembly.

Section 502. Submission of Resolutions for Certain Improvements; Reports Thereon.—All resolutions of the county commissioners relating to the location of any public building in the county, and to the location, extension, widening, enlargement, ornamentation, or parking, of any street, boulevard, parkway, bridge, tunnel, subway, or underground road, park, playground, or other public grounds, to the vacation of any highway or portion thereof, or to the making or alteration of the county plan of highways, or to any surface, underground, or elevated railway, shall be furnished to the County Planning Commission, if one has been created, twenty days before their passage and adoption by the county commissioners. The said commission may make a report or suggestion in relation thereto if it deems the report necessary or advisable for the consideration of the said commissioners. If the said report is made by the commission prior to the expiration of the said twenty days, the county commissioners may immediately proceed with the adoption of the said resolution. All such reports, when delivered to the said commissioners, shall be for the information of the public, as well as for the commissioners, and the commissioners shall furnish to any newspaper of the county on request for publication a copy of any such report.

Section 503. Appearance in Court.—The County Planning Commission may appear in any proceeding in the court of quarter sessions of said county, with reference to the opening or vacation of any public road or highway, bridge, tunnel, subway or underground road, and file a report, stating its view with reference thereto, and may produce testimony before the said court in connection therewith.

Section 504. Plans of Subdivisions; Jurisdiction; Scope of Subdivisions; Regulations; Procedure; Penalties.—The County Planning Commission shall have jurisdiction and control of the subdivision of land located within the county limits. For the purpose of this section a subdivision shall be construed to be: A division of any part, parcel or area of land by the owner or

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agent, either by lots or by metes and bounds into lots or parcels three or more in number for the purpose of conveyance, transfer, improvement or sale with appurtenant roads, streets, lanes, alleys and ways, dedicated or intended to be dedicated to public use, or the use of purchasers or owners of lots fronting thereon. All plans, plots, and replots of land laid out in building lots, and the streets, highways, alleys or other portions of the same intended to be dedicated to public use, or the use of purchasers or owners of lots fronting thereon or adjacent thereto, located within the county limits, except those located within any city or borough within the said counties shall be submitted to the County Planning Commission, if one has been created, and approved by it before they shall be recorded. And it shall not be lawful to receive or record any such plan in any public office, unless the same shall bear thereon by endorsement or otherwise the approval of the County Planning Commission, if one has been created. The disapproval of any such plan by the County Planning Commission shall be deemed a refusal of the proposed dedication shown thereon. The approval of the commission shall be deemed an acceptance of the proposed dedication, but shall not impose any duty upon the county concerning maintenance or improvement of any such dedicated streets, highways, alleys or other portions of the same, until the proper authorities of the county shall have made actual appropriation of the same by entry, use or improvement. The owners and purchasers of such lots shall be conclusively presumed to have notice of public plans, maps, and reports of the commission affecting such property within its jurisdiction. Any owner, or agent of the owner, of any land located within a subdivision, who sells, transfers or agrees to sell, any land by reference to, or exhibition of, or by other use of a plan of a subdivision, before the same has been approved by the County Planning Commission shall upon summary conviction thereof before any alderman or justice of the peace of the county be sentenced to pay a fine of not less than fifty dollars ($50), or more than one hundred dollars ($100), and the cost of the prosecution, or undergo an imprisonment for a term of not more than thirty days for each lot or parcel transferred or sold, or agreed to be sold, and the description of such lot or parcel by metes and bounds in the instrument of transfer, or other document used in the process of selling or transferring, shall not exempt the transaction from such penalties, or from the remedies herein provided. Counties may also enjoin such transfer or sale or agreement by action for injunction brought in any court of equity jurisdiction, in addition to the penalty herein provided.

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Section 505. Maps of County.—The County Planning Commission may make, or cause to be made, and laid before the said county commissioners, and in its discretion cause to be published, a map or maps of the county, and any portion or portions thereof, including the territory extending three miles beyond the county limits, showing the highways and other public improvements hereinbefore specified, and other natural or artificial features, and also locations proposed by it for any new highways, or other of such improvements, or any widening, extension or relocation of the same, or any change in the county plan by it deemed advisable.

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Section 506. Recommendations to County Commissioners and Others.—It may make recommendations to the said commissioners, from time to time,

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concerning any such matters and things aforesaid, for action of the county commissioners thereon, and, in so doing, have regard for present conditions and future needs and growth of the county, and the distribution and relative location of all the principal streets and railways, waterways, and all other means of public travel and business communication, as well as the distribution and relative location of public buildings, public grounds, and open spaces devoted to public use, and the planning and laying out for dwelling and business purposes of private grounds brought into the market from time to time.

The County Planning Commission may make recommendations to any public authorities, or any corporations or individuals in such counties, with reference to the location of any buildings, structures, or works to be erected or constructed by them.

Section 507. Cooperation between Commission and Political Subdivisions.—The county planning commission shall encourage the cooperation of the political subdivisions within the county in any matters whatsoever which may concern the integrity of the county plan, or maps prepared by the commission as an aid toward coordination of municipal plans with the county plans, and it shall be the duty of every city, borough, town and township within a county having a County Planning Commission, having prepared any maps or plans by a duly authorized planning commission, to file a copy thereof, and any subsequent amendments thereto, with the County Planning Commission within sixty days from the effective date of this act, or within thirty days of the completion of such plan or map.

Section 507.1. Local Authorities to Submit Plans to County Planning Commission.—Before the approval of a plat by any city, borough, town or township authority having the power of approval of plats, such authority shall transmit a copy of the proposed plat to the County Planning Commission, if one has been created, and the commission shall make a report thereon to such local authority. Pending the receipt and consideration of such report, such local authority shall defer action thereon, but if such report be not received by the local authority within twenty days from the submission of the plat to the county planning commission, or within such further time as may be agreed upon by the local authorities, such local authority may proceed to final action thereon.

Section 507.2. Creation of Regional Planning Commission.—The councils or corresponding administrative bodies of any group of political subdivisions independently or together with the county commissioners of any county or counties in which such group of political subdivisions is located, or of any adjoining county or counties, or the council or corresponding administrative body of any political subdivision, together with the county commissioners in which such political subdivision is located, or the county commissioners of any two or more adjoining counties, may cooperate in the creation of a regional planning commission for any region defined, as may be agreed upon by said cooperating councils, authorities, and county commissioners, or by said cooperating county commissioners. The number and qualifications of the members of any such regional

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planning commission and their terms and method of appointment or removal shall be such as may be determined and agreed upon by said cooperating authorities and county commissioners: Provided, however, That a majority of the members of the regional planning commission shall hold no other public office or position, excepting appointive membership on a municipal or other planning commission. Members of the regional planning commission shall serve without salary, but may be paid expenses incurred in the performance of duties. The proportion of the expenses of the regional planning commission to be borne, respectively, by the political subdivisions and counties, or by the counties cooperating in the establishment and maintenance of the commission, shall be such as may be determined and agreed upon by the cooperating authorities and county commissioners, and said authorities and county commissioners are hereby authorized to appropriate their respective shares of such expenses. Within the amounts thus agreed upon and duly appropriated any such regional planning commission shall have the power to appoint such employes and staff as it may deem necessary for its work, and contract with planners and other consultants for such services as it may require. The regional planning commission shall elect its chairman, who shall hold no other public office or position, except that he may be a member of a municipal or other planning commission. The term of the chairman shall be one year, with eligibility for reelection. The commission may create and fill such other offices as it may determine. It shall adopt rules for the transaction of business and shall keep a record of its resolutions, transactions, findings, and determinations, which record shall be a public record. The county commissioners or other county official, or the chief executive officer or body of any political subdivision, may, from time to time, upon the request of the commission, and, for the purpose of special surveys, assign or detail to the commission any officers or employees of the county or political subdivision to make, for the commission, special surveys or studies requested by the commission.

ROCEDURES

Section 507.3. Regional Planning Commission to Make Master Plan.—It shall be the function and duty of the regional planning commission to make a master plan and such surveys and studies as may be essential thereto for the physical development of the region, as created in accordance with the provisions of section 507.2 of this act. Such master plan shall include all the elements of physical development that may be locally important and desirable.

Section 507.4. Delegated Powers of Regional Planning Commission.—The council or corresponding administrative bodies of any political subdivision, and the county commissioners of any county so cooperating, may delegate to the regional planning commission, by ordinance or resolution, any or all of the powers and duties of the planning commission of such political subdivision, with respect to the territory of the political subdivision so enacting or resolving, and, in case of a county, any and all of the powers and duties of a county planning commission for the territory of the county so resolving.

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(b) County Zoning

(P. L. 2129, 1937)

Section 510.1. Grant of Power.—The board of county commissioners of any county is hereby empowered, in accordance with the conditions and procedure specified in the subsequent sections of this article, by ordinance, to regulate in any portion or portions of such county which lie outside of cities, boroughs and townships of the first class, the location, height, bulk, and size of buildings and other structures, the percentage of lot which may be occupied, the size of yards, courts, and other open spaces, the density and distribution of population, the uses of buildings and structures for trade, industry, residence, recreation, public activities or other purposes, and the uses of land for trade, industry, residence, recreation, agriculture, water supply conservation, soil conservation, forestry or other purposes.

Section 510.2. Zoning Commission.—In order to avail itself of the powers conferred by this act, the board of county commissioners shall appoint a permanent commission of three, five or seven members, which shall be known as the county zoning commission.

Any individual, whether in private or ex-officio capacity, may be appointed to serve on such commission, and the majority of the members thereof shall be individuals who do not hold elective public office. The boards of county commissioners of two or more counties may arrange or provide for a joint or common commission, and, for the purposes of this act, any such joint or common zoning commission shall be deemed the zoning commission of each of such counties. The board of county commissioners shall provide for reimbursement of the members of the zoning commission for actual expenses incurred, and shall provide for the filling of vacancies in the membership of such commission, and for the removal of a member for non-performance of duty or misconduct.

In any county where a county planning board has been or shall be established, the board of county commissioners may, in lieu of establishing a zoning commission as provided in this section, confer and impose on such planning board the additional power and duty of serving as the county zoning commission with all the powers and duties conferred by this act upon the county zoning commission.

Section 510.3. Assistance from State Agencies; Personnel.—The zoning commission is directed to make use of the expert advice and information which may be furnished by appropriate State and Federal officials, departments, and agencies, particularly the Pennsylvania State Planning Board, and all State officials, departments, and agencies having information, maps, and data pertinent to county zoning are hereby authorized and directed to make the same available for the use of the county zoning commission, as well as to furnish such other technical assistance and advice as they may have available for such purpose. The zoning commission may employ such trained personnel as the funds provided therefor may permit.

Section 510.4. Preparation of Zoning Plan.—It shall be the duty of the zoning commission of any county to make, for certification to the board of county commissioners of such county, a zoning plan or plans, including both

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the full text of the zoning ordinance or ordinances and the maps and representing the recommendations of the commission for the regulation by districts or zones of the location, height, bulk, and size of buildings and other structures, percentage of lot which may be occupied, the size of lots, courts, and other open spaces, the density and distribution of population, the location and use of buildings and structures for trade, industry, residence, recreation, public activities or other purposes, and the uses of land for trade, industry, recreation, agriculture, forestry, soil conservation, water supply conservation or other purposes.

When the efforts of such commission shall have reached the stage of a tentative plan, the commission shall hold at least one public hearing on each tentative plan to be separately submitted, notice of which hearings shall be published at least fifteen days before the date of the hearing in a newspaper of general circulation in the county. The notice shall contain the time and place of hearing, and shall specify the place and times at which the tentative text and maps of the zoning ordinance may be examined. For the purpose of its public hearing or hearings, the commission shall have power to summon witnesses, administer oaths, and compel the giving of testimony.

Before finally adopting and certifying any zoning plan, the zoning commission shall submit its tentative plan to the State Planning Board for advice and recommendations. The approval of the State Planning Board shall be presumed unless the State Planning Board shall, within forty-five days after such submission, present its advices and criticisms in respect to such zoning plan.

In the event that, after such public hearing or hearings and after such submission to the State Planning Board, the zoning commission, in the light of the developments at such hearing or hearings or the advices and recommendations of the State Planning Board, makes changes in its said tentative plan, there shall be no requirement of any hearing upon such changes or any submission of such changes to the State Planning Board.

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Section 510.5. Zoning Ordinance.—From and after the time when a zoning commission of any county, in accordance with the procedure specified in the next preceding section of this article, makes, adopts, and certifies to the board of county commissioners of its county, each zoning plan, including both the full text of a zoning ordinance and the maps, then the board of county commissioners may, by ordinance, exercise the powers granted to it in section five hundred ten and one-tenth of this act, and, for the purpose of such exercise, the board of county commissioners may divide the territory of the county, which lies outside of municipalities which now have authority to adopt and enforce zoning ordinances, into districts or zones of such number, shape or area as it may determine, and within such districts, or any of them, may regulate the erection, construction, reconstruction, alteration, and uses of buildings and structures and the uses of land, and may require and provide for the issuance of building permits as a condition precedent to the right to erect, construct, reconstruct or alter any building or structure within any district covered by such zoning ordinance. All such regulations shall be uniform for each class or kind of buildings throughout any district, but the regulations in one district may differ from those in other districts.

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Section 510.6. Method of Procedure.—After receiving the certification of a zone plan from the zoning commission and before the enactment of any zoning ordinance, the board of county commissioners shall hold a public hearing thereon, of the time and place of which at least thirty days' notice shall be given by one publication in a newspaper of general circulation in the county. Such notice shall state the place at which the text and maps as certified by the zoning commission may be examined. The board may conduct consultative hearings or referenda to aid it in determining the desirability of contemplated or recommended regulations. No change in or departure from the text or maps, as certified by the zoning commission, shall be made unless such change or departure shall first be submitted to the zoning commission for its approval or disapproval or suggestions. The zoning commission shall have thirty days from and after such submission within which to send its report to the board of county commissioners: Provided, however, That no approval, disapproval or suggestions of the zoning commission shall have more than advisory effect or shall in anywise bind the board of county commissioners.

Section 510.7. Purposes of Zoning Regulations.—Such regulations shall be designated and enacted for the purpose of promoting the health, safety, morals, convenience, order, prosperity or welfare of the present and future inhabitants of the State of Pennsylvania, including, amongst other things, the lessening of congestion in the streets or roads or reducing the waste of excessive amounts of roads, securing safety from fire and other dangers, providing adequate light and air, preventing on the one hand excessive concentration of population and on the other hand excessive and wasteful scattering of population or settlement, promoting such distribution of population and such classification of land uses and distribution of land development and utilization as will tend to facilitate and conserve adequate provisions for transportation, water flowage, water supply, drainage, sanitation, educational opportunities, recreation, soil, fertility, food supply, protection of the tax base, securing economy in governmental expenditures, fostering the State's agricultural and other industries, and the protection of both urban and non-urban development.

Section 510.8. Amendments.—The board of county commissioners may, from time to time, amend the number, shape, boundary or area of any district or districts, or any regulation of, or within, such district or districts, or any other provision of any zoning ordinance, but no such amendment shall be made or become effective until the same shall have been proposed by or be first submitted for approval, disapproval or suggestions to the zoning commission and the Pennsylvania State Planning Board. Any proposal, approval, disapproval or suggestions of the zoning commission or the State Planning Board shall have advisory effect only and not be binding upon the board of county commissioners, and, unless such zoning commission or State Planning Board shall have transmitted its report upon the proposed amendment within thirty days after the submission thereof to it, the board of county commissioners shall be free to proceed to the adoption of the amendment without further awaiting the receipt of the report* of the zoning com-

* "port" in the original.

mission or State Planning Board. Before finally adopting any such amendment, the board of county commissioners shall hold a public hearing thereon, at least thirty days' notice of the time and place of which shall be given by at least one publication in a newspaper of general circulation in the county.

Section 510.9. Cooperation Between Counties.—The zoning commission of any county may cooperate with the zoning commissions of other counties and with the planning, zoning, legislative, and administrative authorities of cities, boroughs, first-class townships or other municipalities, either within or without such county, with a view to coordinating and integrating the zoning of the county with the planning and zoning of other counties or of municipalities. The zoning commission shall also have power to appoint such committee or committees, and adopt such rules for the conduct of its business, as it may deem proper to effect such cooperation or to more expeditiously and effectively perform its functions.

Section 510.10. The Board of Adjustment.—The board of county commissioners of any county which enacts zoning regulations under the authority of this act, shall provide for a board of adjustment of three to five members and for the manner of the appointment of such members. Not more than half of the members of such board may at any time be members of the zoning commission. The board of county commissioners shall fix per diem compensation and terms for the members of such board of adjustment, which terms shall be of such length and so arranged that the term of at least one member will expire each year. Any member of the board of adjustment may be removed for cause by the board of county commissioners upon written charges and after a public hearing. Vacancies shall be filled for the unexpired term in the same manner as in the case of original appointments. The board of county commissioners may appoint associate members of such board, and in the event that any regular member be temporarily unable to act owing to absence from the county, illness, interest in a case before the board or any other cause, his place may be taken during such temporary disability by an associate member designated for the purpose. The boards of county commissioners of two or more counties may arrange and provide for a joint or common board of adjustment of four or five members, which joint or common board of adjustment shall be deemed the board of adjustment of each of such counties.

The board of county commissioners shall provide and specify in its zoning or other ordinances general rules to govern the organization, procedure, and jurisdiction of said board of adjustment, which rules shall not be inconsistent with the provisions of this act, and the board of adjustment may adopt supplemental rules of procedure not inconsistent with this act or such general rules.

Any zoning ordinance of the board of county commissioners may provide that the board of adjustment may in appropriate cases and subject to appropriate principles, standards, rules, conditions, and safeguards set forth in the zoning ordinance, make special exceptions to the terms of the zoning regulations in harmony with their general purpose and intent. The commissioners may also authorize the board of adjustment to interpret the zoning maps and pass upon disputed questions of lot lines or district boundary lines

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or similar questions, as they may arise in the administration of the zoning regulations.

Meetings of the board of adjustment shall be held at the call of the chairman and at such other times as the board in its rules of procedure may specify. The chairman or in his absence the acting chairman may administer oaths and compel the attendance of witnesses. All meetings of the board of adjustment shall be open to the public. The board shall keep minutes of its proceedings showing the vote of each member upon each question, or if absent or failing to vote, indicating such fact, and shall keep records of its examinations and other official actions, all of which shall be immediately filed in the office of the board and shall be a public record.

Section 510.11. Appeals to the Board of Adjustment.—Appeals to the board of adjustment may be taken by any person aggrieved by his inability to obtain a building permit, or by the decision of any administrative officer or agency based upon or made in the course of the administration or enforcement of the provisions of the zoning ordinance. Appeals to the board of adjustment may be taken by any officer, department, board or bureau of the county affected by the grant or refusal of a building permit or by other decision of an administrative officer or agency based on or made in the course of the administration or enforcement of the provisions of the zoning ordinance. The time within which such appeal must be made, and the form or other procedure relating thereto, shall be as specified in the general rules provided by the board of county commissioners to govern the procedure of such board of adjustment or in the supplemental rules of procedure adopted by such board.

Upon appeals the board of adjustment shall have the following powers:

(1) To hear and decide appeals where it is alleged by the appellant that there is error in any order, requirement, decision or refusal made by an administrative official or agency based on or made in the enforcement of the zoning ordinance.

(2) To hear and decide, in accordance with the provisions of any such ordinance, requests for special exceptions or for interpretation of the map or for decisions upon other special questions upon which such board is authorized by any such ordinance to pass.

(3) Where by reason of exceptional narrowness, shallowness or shape of a specific piece of property at the time of the enactment of the regulation, or by reason of exceptional topographic conditions or other extraordinary and exceptional situation or condition of such piece of property, the strict application of any regulation enacted under this act would result in peculiar and exceptional practical difficulties to, or exceptional and undue hardship upon, the owner of such property to authorize, upon an appeal relating to said property, a variance from such strict application so as to relieve such difficulties or hardship, provided such relief may be granted without substantial detriment to the public good and without substantially impairing the intent and purpose of the zone plan and zoning ordinances.

The concurring vote of four members of the board in the case of a five-member board, and of three members in the case of a three-member board, shall be necessary to reverse any order, requirement, decision or determina-

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tion of any such administrative official or agency or to decide in favor of the appellant.

Section 510.12. Court Review.—Any persons jointly or severally aggrieved by any decision of the board of adjustment or any taxpayer or any officer, department, board or bureau of the county may present to the court of common pleas of the county, in which the property concerning which such decision was made is located, a petition duly verified, setting forth that such decision is illegal in whole or in part, specifying the grounds of the illegality. Such a petition shall be presented to the court within thirty days after the filing of the decision in the office of the board. Upon the presentation of such petition, the court may allow a writ of certiorari, directed to the board of adjustment, to review such decision of the board of adjustment, and shall prescribe therein the time within which a return thereto must be made and served upon the relator's attorney, which shall not be less than ten days and may be extended by the court. The allowance of the writ shall not stay proceedings upon the decision appealed from, but the court may, on application, on notice to the board and on due cause shown, grant a restraining order. The board of adjustment shall not be required to return the original papers acted upon by it, but it shall be sufficient to return certified or sworn copies thereof, or of such portions thereof as may be called for by such writ. The return shall concisely set forth such other facts as may be pertinent and material to show the grounds of the decision appealed from and shall be verified. If, upon the hearing, it shall appear to the court that testimony is necessary for the proper disposition of the matter, it may take evidence, or appoint a referee to take such evidence as it may direct and report the same to the court with his findings of fact and conclusions of law, which shall constitute a part of the proceedings upon which the determination of the court shall be made. The court may reverse or affirm, wholly or partly, or may modify the decision brought up for review.

Costs shall not be allowed against the board, unless it shall appear to the court that it acted with gross negligence or in bad faith or with malice in making the decision appealed from.

All issues in any proceeding under this section shall have preference over all other civil actions and proceedings.

Section 510.13. Violations; Enforcement and Remedies.—It shall be unlawful to erect, construct, reconstruct, alter, maintain or use any building or structure or to use any land in violation of any regulation in, or of any provision of, any zoning ordinance, or any amendment thereof, enacted or adopted by any board of county commissioners under the authority of this act. Any person, firm or corporation violating any such regulation, provision or amendment, or any provision of this act, shall be guilty of a misdemeanor, and, upon conviction thereof, shall be fined not more than one hundred dollars ($100.00), or imprisoned not more than ten days, or both. Each and every day during which such illegal erection, construction, reconstruction, alteration, maintenance or use continues shall be deemed a separate offense. In case any building or structure is or is proposed to be erected, constructed, reconstructed, altered, maintained or used, or any land

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is or is proposed to be used, in violation of this act or of any regulation or provision of any ordinance, or amendment thereof, enacted or adopted by any board of county commissioners under the authority granted by this act, such board, the district attorney of the county or any owner of real estate within the district in which such building, structure or land is situated, may, in addition to other remedies provided by law, institute injunction, mandamus, abatement or any other appropriate action or actions, proceeding or proceedings to prevent, enjoin, abate or remove such unlawful erection, construction, reconstruction, alteration, maintenance or use.

Section 510.14. Nonconforming Uses.—The lawful use of a building or structure, or the lawful use of any land, as existing and lawful at the time of the enactment of a zoning ordinance, or in the case of an amendment of an ordinance, then at the time of such amendment, may, except as hereinafter provided, be continued although such use does not conform with the provisions of such ordinance or amendment, and such use may be extended throughout the same building, provided no structural alteration of such building is proposed or made for the purpose of such extension. The board of county commissioners may provide in any zoning ordinance for the restoration, reconstruction, extension or substitution of nonconforming uses upon such terms and conditions as may be set forth in the zoning ordinance. The board of county commissioners may in any zoning ordinance provide for the termination of nonconforming uses, either by specifying the period or periods in which nonconforming uses shall be required to cease, or by providing a formula or formulae whereby the compulsory termination of a nonconforming use may be so fixed as to allow for the recovery or amortization of the investment in the nonconformance.

If any county acquire title to any property by reason of tax delinquency and such properties be not redeemed as provided by law, the future use of such property shall be in conformity with the then provisions of the zoning ordinance of the county, or with any amendment of such ordinance, equally applicable to other like properties within the district in which the property acquired by the county is located.

Section 510.15. List of Nonconforming Uses.—Immediately after the adoption of any zoning ordinance or amendment by the board of county commissioners, the county zoning commission shall prepare and publish a complete list of all nonconforming uses and occupations existing at the time of the adoption of such ordinance or amendment. Such list shall contain the names and addresses of the owner or owners of such nonconforming use and of any occupant, other than the owner, the legal description or descriptions of the land, and the nature and extent of land use. After any necessary corrections have been made under a procedure prescribed by the board of county commissioners, copies of such list shall, when approved by such body, be filed for record in the offices of the recorder of deeds and of the chief clerk in the county in which the lands are situated, and shall be corrected yearly as the board of county commissioners may prescribe.

Section 510.16. Filing.—Upon the adoption of any zoning ordinance or regulation, map or maps, the board of county commissioners may file the originals with the chief clerk and a certified copy of each in the office of the

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county recorder of deeds, which copies shall be accessible to the public. The recorder of deeds shall index such ordinances and regulations as nearly as possible in the same manner as he indexes instruments pertaining to the title of land.

Section 510.17. Finances.—The board of county commissioners is empowered to appropriate out of the general county fund such moneys, otherwise unappropriated, as it may deem fit to finance the work of the county zoning commission and of the board of adjustment, and to enforce the zoning regulations and restrictions which are adopted, and to accept grants of money and service for these purposes, and other purposes, in accordance with this act, from either private or public sources, State or Federal.

Section 510.18. Conflict with Other Laws.—Whenever any regulations made under authority of this act require a greater width or size of yards, courts or other open spaces, or require a lower height of buildings or smaller number of stories, or require a greater percentage of lot to be left unoccupied, or impose other higher standards than are required in or under any other statute, the provisions of the regulations made under authority of this act shall govern. Whenever the provisions of any other statute require a greater width or size of yards, courts or other open spaces, or require a greater percentage of lot to be left unoccupied, or impose other higher standards than are required by any regulations made under authority of this act, the provisions of such statute shall govern.

Section 510.19. Act Not to Apply to Certain Buildings of Public Utility Corporations.—This act shall not apply to any existing or proposed building, or extension thereof, used or to be used by public utility corporations, if, upon petition of the corporation, the Pennsylvania Public Utility Commission shall, after a public hearing, decide that the present or proposed situation of the building in question is reasonably necessary for the convenience or welfare of the public.

Section 510.20. Definitions.—The words "amend," "amendment," "amendments" or "amended," in this act, shall be deemed to include any modification of the text or phraseology of any provision of any zoning ordinance, or amendment thereof, or any repeal or elimination of any such provision, or part thereof, or any addition to the ordinance, or to an amendment thereof, and shall also be deemed to include any change in the number, shape, boundary or area of any district or districts, any repeal or abolition of any map forming part of, or referred to, in any zoning ordinance or any part of such map, any addition to such map, any new map or maps, or any other change in the maps or any map.

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REVISED TEXT OF "TOWNSHIP (SECOND CLASS) ZONING ENABLING ACT"

(Originally passed as Act No. 504, Session of 1937, P. L. 2624)

Revised in the Second Class Township Code, Approved July 10, 1947, Act No. 567

AN ACT

Concerning townships of the second class; amending, revising, consolidating and changing the law relating thereto.

ARTICLE XX

ZONING

Section 2001. Grant of Power.—For the purpose of promoting health, safety, morals or the general welfare of townships of the second class, the supervisors are hereby empowered to regulate and restrict the height, number of stories and size of buildings and other structures, their construction, alteration, extension, repair, maintenance and all facilities and services in or about such buildings and structures, and percentage of lot that may be occupied, the size of yards, courts and other open spaces, the density of population and the location and use of buildings, structures and land for trade, industry, residence or other purposes, and may also establish and maintain building lines and set back building lines upon any or all public roads or highways. The power hereby granted shall be suspended in any township, or part of a township, during any period of time that any zoning ordinance, adopted pursuant to law by the county commissioners of the county, shall continue to be in effect in such township, or part of a township, and any ordinance adopted by any township before the adoption of such county ordinance shall likewise be suspended during such period. The power hereby granted shall not be exercised, if taxpayers, whose property valuation as assessed for tax purposes within the township shall amount to fifty-one per centum or more of the total property valuation as assessed for tax purposes within the township or within the district of the township affected, if the township has been divided into districts as hereinafter provided, shall sign and file in the office of the prothonotary of the county in which the ownership is located, a written protest against the exercise of such powers.

Section 2002. Districts; Procedure.—(a) For any or all said purposes, the supervisors may divide the township into districts of such number, shape and area as may be deemed best suited to carry out the purpose of this article, and within such districts, it may regulate and restrict the erection, construction, reconstruction, alteration, repair or use of buildings, structures or land. All such regulations shall be uniform for each class or kind of buildings throughout each district, but the regulations in one district may differ from those in another district.

(b) The supervisors shall provide, by ordinance, the manner in which the boundaries of such districts shall be determined and established, and

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from time to time amended or changed. However no such boundary shall become effective until after public hearing in relation thereto at which parties in interest and citizens shall have an opportunity to be heard. At least fifteen days' notice of the time and place of such hearing shall be published in a newspaper of general circulation in such township.

Section 2003. Purpose in View.—All regulations made pursuant to the powers granted in this article shall be made in accordance with a comprehensive plan and designed to lessen congestion in the roads and highways; to secure safety from fire, panic and other dangers; to promote health and the general welfare; to provide adequate light and air; to prevent the overcrowding of land; to avoid undue congestion of population; to facilitate the adequate provision of transportation, water, sewerage, schools, parks and other public requirements. Such regulations shall be made with reasonable consideration, among other things, to the character of the district and its peculiar suitability for particular uses, and with a view to conserving the value of buildings and encouraging the most appropriate use of land throughout such municipality.

Section 2004. Method of Procedure.—The supervisors shall exercise the powers granted in section 2001 hereof, by ordinance, which shall provide for the enforcement of the regulations and restrictions established therein by reasonable fines and by the instituting of appropriate actions or proceedings at law or in equity, and for at least one week and not more than three weeks prior to the presentation of the proposed ordinance, a notice of intention to consider such proposed ordinance and a brief summary setting forth the principal provisions of the proposed ordinance, in such reasonable detail as will give adequate notice of its contents, and a reference to the place or places within the township where copies of the proposed ordinance may be examined. The Department of Internal Affairs shall prepare suitable forms for such notice, which may be used by the supervisors of any township for this purpose.

The provisions of the ordinance need not be advertised or recorded as in other cases. Provisions respecting the construction, alteration, extension, repair, care and maintenance of buildings and structures may be supplied by reference to a standard building code, approved by the Department of Internal Affairs, or to parts thereof, determined by the supervisors, or such provisions of the ordinance may be supplied by reference to a typed or printed building code, prepared under the direction of or accepted by the supervisors, or such provisions may consist of a standard code, approved as aforesaid, or parts thereof, and also further provisions typed or printed as aforesaid. Copies of the provisions of the ordinance thus adopted by reference shall be made available to any interested party at the cost thereof, or may be furnished or loaned without charge and a copy of such provisions of the ordinance, whether by reference to a standard building code or a combination of them shall be attached to the ordinance book with the same force and effect as if duly recorded therein.

The procedure set forth relating to the adoption of the ordinance may likewise be adopted in amending, supplementing or repealing any of the provisions of the ordinance.

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Section 2005. Changes.—Such regulations, restrictions and boundaries may from time to time be amended, supplemented, changed, modified or repealed. In case, however, of a protest against such change, signed by the owners of twenty percent or more either of the area of the lots included in such proposed change or of those immediately adjacent in the rear thereof extending one hundred feet from the street frontage of such opposite lots, such amendment shall not become effective except by the favorable vote of all the supervisors.

Section 2006. Zoning Commission.—In order to avail themselves of the powers conferred by this act, the supervisors shall appoint a commission of five citizens of the township to be known as the zoning commission, to recommend the boundaries of the various original districts and appropriate regulations to be enforced therein. Such commission may consult the State Planning Commission of the Department of Commerce, and shall make a preliminary report and hold public hearings thereon before submitting its final report, and the supervisors shall not take action until they have received the final report of such commission.

Section 2007. Board of Adjustment.—The supervisors may appoint a board of adjustment, and in the regulations and restrictions adopted pursuant to the authority of this article, may provide that said board of adjustment may, in appropriate cases and subject to appropriate conditions and safeguards, make special exceptions to the terms of the ordinance in harmony with its general purpose and intent and in accordance with general or specific rules therein contained.

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The board of adjustment shall consist of three members, one of whom shall be designated to serve until the first day of January following the adoption of the zoning ordinance, one until the first day of the second January thereafter, and one until the first day of the third January thereafter. Their successors shall be appointed on the expiration of their respective terms to serve three years. The members of the board shall be removable for cause by the appointing authority upon written charges and after public hearing. Vacancies shall be filled for the unexpired term of any member whose term becomes vacant.

The board of adjustment shall adopt rules in accordance with the provisions of any ordinance adopted pursuant to this article. Meetings of the board shall be held at the call of the chairman and at such other times as the board may determine. The chairman or in his absence the acting chairman may administer oaths and compel the attendance of witnesses. All meetings of the board shall be open to the public. The board shall keep minutes of its proceedings showing the vote of each member upon each question, or if absent, or failing to vote, indicating such fact and shall keep records of its examinations, and other official actions all of which shall be immediately filed with the township secretary and shall be a public record.

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Appeals to the board of adjustment may be taken by any person aggrieved or affected by any decision of the supervisors. Such appeal shall be taken within a reasonable time as provided by the rules of the board by filing with the township secretary and with the board of adjustment, a notice of appeal

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specifying the grounds thereof. The secretary shall forthwith transmit to the board all the papers constituting the record upon which the action appealed from was taken.

An appeal shall stay all proceedings in furtherance of the action appealed from, unless the supervisors certify to the board of adjustment, after the notice of appeal shall have been filed, that by reason of facts stated in the certificate a stay would in their opinion cause imminent peril to life and property. In such case proceedings shall not be stayed otherwise than by a restraining order, which may be granted by the board of adjustment or by a court of record on application, on notice to the supervisors and due cause shown.

The board of adjustment shall fix a reasonable time for the hearing of the appeal, give public notice thereof, as well as due notice to the parties in interest, and decide the same within a reasonable time. Upon the hearing, any party may appear in person or by agent or by attorney.

The board of adjustment shall have the following powers:

(1) To hear and decide appeals where it is alleged there is error in any order, requirement, decision or determination made by the supervisors in the enforcement of this article or of any ordinance adopted pursuant thereto.

(2) To hear and decide special exceptions to the terms of the ordinance upon which such board is required to pass under such ordinance.

(3) To authorize, upon appeal, in specific cases such variance from the terms of the ordinance as will not be contrary to public interest, where owing to special conditions a literal enforcement of the provisions of the ordinance will result in unnecessary hardship, and so that the spirit of the ordinance shall be observed and substantial justice done.

In exercising the above mentioned powers, such board may, in conformity with the provisions of this article, reverse or affirm, wholly or partly, or may modify, the order, requirement, decision or determination appealed from, and may make such order, requirement, decision or determination as ought to be made. Notice of such decision shall forthwith be given to all parties in interest.

Any person aggrieved by any decision of the board of adjustment or any taxpayer or any supervisor may, within thirty days after such decision of the board, appeal to the court of common pleas of the county, by petition duly verified, setting forth that such decision is arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law, specifying the grounds upon which he relies. Upon presentation of the petition in proper form, the court shall forthwith issue a writ of certiorari directed to the board of adjustment commanding it, within twenty days after the service thereof, to certify to the court, under the certificate of its chairman, its entire record in the matter in which the appeal has been taken. The prothonotary shall serve the board of adjustment by registered mail with a copy of the writ and a copy of the appeal petition. On or before the return day of the writ the board of adjustment shall file the entire record with the writ in the office of the prothonotary.

Any time during the pendency of an appeal, upon application of the appellant and upon due notice to the board of adjustment, the court or a

judge thereof, may, after hearing, grant an order of supersedeas upon such terms and conditions including the filing of security as the court or the judge thereof may prescribe.

If upon the hearing of the appeal, it shall appear to the court that testimony is necessary for the proper disposition of the appeal, it may take evidence or appoint a referee to take such evidence, as it may direct, and report the same to the court with his findings of fact and conclusions of law. The court may reverse or affirm, in whole, or in part, or may modify, the decision appealed as to it may appear just and proper.

Costs shall not be allowed against the board, unless it shall appear to the court that it acted with gross negligence or in bad faith or with malice in making the decision appealed from.

Section 2008. Remedies.—In case any building or structure is erected, constructed, reconstructed, altered, repaired, converted or maintained or any building structure or land is used in violation of this article, or of any ordinance or other regulation made under authority conferred hereby, the supervisors, in addition to other remedies, may institute any appropriate action or proceedings to prevent such unlawful erection, construction, reconstruction, alteration, repair, conversion, maintenance or use to restrain, correct or abate such violation, to prevent the occupancy of said building, structure or land, or to prevent any illegal act, conduct, business or use in or about such premises.

Section 2009. Certain Buildings of Public Utility Corporations Exempted.—This article shall not apply to any existing or proposed building, or extension thereof, used or to be used by a public utility corporation, if, upon petition of the corporation, the Public Utility Commission shall after a public hearing decide that the present or proposed situation of the building in question is reasonably necessary for the convenience or welfare of the public.

Section 2010. Finances.—The supervisors are empowered to appropriate out of the General Township Fund, such moneys, otherwise unappropriated, as they may deem fit, to finance the work of the township zoning commission and the board of adjustment, and to enforce the zoning regulations and restrictions which are adopted, and to accept grants of money and service for these purposes from either private or public sources, State or Federal.

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REVISED TEXT OF "REGIONAL PLANNING AND ZONING ENABLING ACT"

Covering Cities of the 3rd Class, *Boroughs,* Incorporated Towns, and Townships, 1943 P. L. 340, 1945 P. L. 206 and P. L. 1339.

AN ACT

Section 1. The word "municipality" as used in this act shall include cities of the third class, boroughs, incorporated towns and townships.

Section 2. (Amendment of 1945). Two or more *adjoining* municipalities may jointly co-operate in the exercise and in the performance of their respective governmental powers, duties and functions and in carrying into effect provisions of law relating to said subjects which are common to all of such joining municipalities, and which each may, under existing law, separately exercise and perform. For the purpose of carrying the provisions of this act into effect the municipalities joining shall enter into such joint agreements as may be deemed appropriate for such purposes.

Section 3. Any joint agreement shall be deemed in force as to any particular municipality, when the same has been adopted by ordinance, or in the case of townships of the second class, by resolution. After adoption, any such agreement shall become binding upon the municipality, and the covenants thereof may be enforced by appropriate remedy by any one or more municipalities against any other municipality party thereto.

Section 4. (Amendment of 1945). Every such agreement shall set forth, inter alia, the particulars relating to the manner of cooperation, the means by and through which such cooperation shall be effectuated, including, if any, the employment of joint personnel, *the employment and retaining of planning engineers or consultants, the contracting for professional planning services* and the purchase of personal property and materials for the joint use of the municipalities, the allocation of the costs and expenses connected with the administration of the joint agreement upon an equitable basis, the term for which the agreement shall be in force, and the manner in which the same may be renewed for another term, and the manner in which joint property shall be disposed of or shared upon the termination of the agreement. Amendments to any agreement shall be adopted in the same manner as the original agreement.

Section 5. All joint purchases involving an expenditure of more than five hundred dollars ($500), shall be made by contract, in writing, only after notice for bids once a week for two weeks in at least one and not more than two newspapers of general circulation circulating generally in the joining municipalities. All contracts shall be let to the lowest responsible bidder.

Section 6. This act shall not be construed to authorize one municipality to delegate any of its powers, duties and functions to another municipality, nor to authorize one municipality to exercise such powers, duties or functions on behalf of another municipality.

Note: See also Section 507.2 to 507.4 of the County Planning and Zoning Enabling Act for specific authorization of regional planning activity.

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RECORDING OF ZONING ORDINANCES

AN ACT

Requiring political subdivisions to file copies of zoning ordinances, together with maps or plans, indicating the area or zones of the political subdivision affected by such ordinances, in the recorder's office; invalidating zoning ordinances hereto adopted unless copies thereof, together with maps, are filed within a certain time; and imposing duties and conferring powers on recorders of deeds.

(Act 400, Approved May 14, 1949)

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 1. Every political subdivision of this Commonwealth authorized by law to adopt zoning ordinances restricting, regulating or otherwise affecting the use of real estate located within the boundaries of such political subdivision, shall file a copy of any such ordinance, or amendment thereto, certified to be true and correct by the proper officer, in the office for the recording of deeds of the county wherein the political subdivision is situate, together with a map or plan of the political subdivision, or part thereof, clearly delineating the affected areas or zones with a brief statement of the type or kind of restriction or regulation for each area or zone.

Section 2. Any zoning ordinance, or amendment thereto heretofore adopted by any political subdivision shall be void and of no effect unless such political subdivision shall comply with the provisions of this act within six months of the effective date hereof. No zoning ordinance hereafter adopted by any political subdivision, nor amendment to an existing zoning ordinance shall become effective until the political subdivision adopting the same shall have complied with the provisions of this act.

Section 3. It shall be the duty of the recorder of deeds of each county of this Commonwealth to provide a suitable "Zoning Ordinance and Map" book, or books, and to maintain an adequate index as part of the same, in which the filed copy of any such zoning ordinance, and amendments thereto, together with the map or plan of the political subdivision, or part thereof, shall be kept. The recorder of deeds shall charge the political subdivision filing the same a fee equal to the fees authorized by law for the same or similar services.

Section 4. All acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

Section 5. The provisions of this act shall become effective immediately.

SELECTED PUBLICATIONS OF THE PENNSYLVANIA STATE PLANNING BOARD

Publication No.

*1—Preliminary Report. 682 pages. 152 charts, December, 1934

*10—Drainage Basin Study. 3 vols., 611 pages, 1937.

15—Recent Industrial Trends and New Employment Opportunities in Pennsylvania.

16—Retail Trade in Pennsylvania, 1946.

17—Industrial Utility of Water in Pennsylvania. Chemical Character of Surface Water, 1944 to 1946. 1947

18—The Pennsylvania Zoning Primer (Revised), 1948.

19—Local Powers for Community Development, 1948.

20—A Pennsylvania Recreation Manual, 1949.

21—Planning and Zoning Powers and Procedures in Pennsylvania, 1949. Vol. 1. (Townships of the Second Class, Counties, Regions.)

22—Planning and Zoning Powers and Procedures in Pennsylvania, 1949. Vol. 2. (Cities, Boroughs, First Class Townships.)

These publications may be seen in representative public libraries. A limited number of those listed are available for distribution until the present supply is exhausted. Those marked with an asterisk are now out of print but may be seen in representative public libraries.

The following issues of **Pennsylvania Planning** are still available.

Local Tax Rates, May-June, 1940.

Community Self-Appraisal (Revised Edition), April, 1942.

Comparative County Data, May, 1942.

Planning and Zoning Progress in Pennsylvania, July, 1942.

Population, October, 1942.

Handicrafts in Post-War Planning, May, 1943.

Plastics, July, 1943.

Air Photographs, February, 1944.

Light Metals and Stainless Steel, August, 1944.

Topographic Mapping Needs, February, 1945. (For limited technical distribution.)

Community Action for Local Self Development, July, 1945.

Conservation, August, 1945.

Forest Resources, November, 1946.

Soil Conservation, September, 1947.

Minerals Conservation, December, 1948.

Know Your Pennsylvania, September, 1949.

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DOCUMENTS

ZONING

A SUPPLEMENT TO
PLANNING & ZONING POWERS & PROCEDURES

STATE PLANNING BOARD
PENNSYLVANIA DEPARTMENT OF COMMERCE

HARRISBURG, PENNSYLVANIA
1952

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Z O N I N G

I. INTRODUCTION

Zoning should be a part of comprehensive planning. In itself, zoning may be defined simply as the division of land into districts having different use and density regulations. In a larger sense, however, the proper concept of zoning should be that it is an instrument for the constructive guidance of the private use of land. It should not be thought of as a negative device for keeping something out, but rather as a positive tool for causing the locality to grow according to a logical plan. The principle is well established that zoning has its highest function in the protection of a sound plan, and the community that creates a zoning ordinance without benefit of comprehensive planning studies is courting almost certain failure in its zoning efforts.

In the past many communities have, with unhappy results, treated zoning as being completely separate from the other phases of municipal planning. These ordinances usually could do little more than freeze existing conditions, or at best, make a guess as to what space would be required for the various uses of land at some future date. It naturally follows that such a zoning plan would soon be compromised beyond recognition by the changing needs of the community. The net result from such action is that the zoning plan becomes ineffective and is often a hundrance to healthy community development.

Zoning ordinances are enacted under the police power, which is the general legislative power of the community to make regulations for the purpose

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Note: This chapter on "Zoning" was prepared by the Pennsylvania State Planning Board at the request of the Public Service Institute.

of promoting the public health, safety, morals, or general welfare of the people of the community. The police power is simply all legislative power except those special subdivisions of the governing power having specific names of their own such as the power of taxation. The precise limits of this power will probably never be defined since they are being constantly extended to meet the needs of an increasingly complex and expanding community life.

In the preparatory work for the zoning of New York City prior to 1916, there were no comprehensive zoning regulations available in this country to use as a guide, and a sharp controversy developed as to which body of legislative power should be utilized. Some officials felt that zoning should be accomplished by the power of eminent domain, that superior dominion of the soverign power over all the property within the state which authorizes it to appropriate all or any part thereof to a necessary public use, reasonable compensation being made. Fortunately, however, the New York City charter provisions proceeded under the principles of the police power. If eminent domain had been used, any restriction that prevented the full private use of a property would necessitate the payment of such loss to the owner. This would have led to a laborious and expensive legal proceeding for virtually every parcel of land. The method would have been clumsy and ineffective. Regulations under the police power, on the other hand, adapts itself easily to the growth and change of the community.

In upholding the legality of zoning as a valid exercise of the police power, the courts have held that a property owner may not use his property exactly as he pleases any more than he may use his automobile or his shotgun in complete accord with his personal desires, and also that the owner who is limited in the use of his property is compensated by the benefits accruing to him from like limitations imposed on his neighbors, assuming always that such

limitations are reasonable and not discriminatory.

In order for local governmental units to provide themselves with zoning protection they must first be authorized to do so by the state. This practice has grown out of the fact that in the early days of zoning, some officials were inclined to feel that zoning was an invasion of private property rights, consequently, the courts were reluctant to uphold such an ordinance unless there was a specific state enabling act for zoning.

In Pennsylvania, Second Class Townships are given the power to zone by Act No. 504 of 1937, P. L. 2624, as amended in 1943 and in the Second Class Township Code, Act No. 567 of 1947.* These laws are intended to supplement the county zoning law by enabling individual rural, or semi-rural townships to provide themselves with zoning protection if no county ordinance has been adopted. The importance of Second Class Townships being able to zone cannot be over-emphasized when one considers that most of the building activity throughout the state is occurring in the township areas outside of established municipal boundaries.

As the law is presently written, Second Class Townships are given the power to zone without being specifically authorized to establish comprehensive planning programs. While this is regrettable, it does not mean that a sound, forward looking zoning plan cannot or should not be accomplished. The Township Enabling Act implies that the planning approach be followed in the preparation of a zoning ordinance when it states that, "such regulations shall be made in accordance with a comprehensive plan." A liberal interpretation including planning studies within the zoning program is both reasonable and desirable because the future layout of roads, parks, school grounds and other public and semi-public service facilities has a very important bearing upon desirable future locations for residential, business, industrial and other

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* Similar powers have been given to cities, boroughs, townships of the first-class and to counties. Although this publication was designed primarily for use in townships of the second-class it is equally applicable in other types of civil sub-divisions.

uses. Furthermore, the experience gained by local zoning commissions during the last twenty-five years has proved conclusively that zoning should be attempted only in connection with, or subsequent to, a comprehensive program of planning studies. In light of this, zoning can best be described as a major tool for the accomplishment of planning goals.

II. DEVELOPMENT OF ZONING

The practice of zoning spread rapidly during the years following 1926 when the legality of comprehensive zoning was established by the United States Supreme Court. However, this growth was limited largely to urban areas for two reasons. First, because it was here that the effects of improper land use were most apparent and secondly, with his historically independent attitude, the American farmer resisted zoning as an invasion of his rights in the land. Only recently have people begun to realize that the benefits that accrue to the individual property owner and to the community as a whole are just as numerous and just as important in rural and semi-rural areas as they are in the city. The resistance to zoning on the part of the farmer stems partly from a misunderstanding of the objectives of a zoning program. He feels that zoning would seek to interfere with his particular farming operation; that it would attempt to regulate his use of the land. In reality, a zoning ordinance for a rural or semi-rural area should be designed to regulate the land uses in such a manner that property values would be protected, public service costs reduced, and the community itself would be made a better, healthier place in which to live. In other words, zoning on a township level seeks to protect the farmer's interest rather than regulate his activity. To amplify this idea it might be well to consider some of the conditions which might be regulated in rural and semi-rural areas by the use of zoning.

The spilling over of urban population beyond their municipal boundaries has presented a grave problem for many formerly stable rural communities.

These urban-rural fringe developments surround both our large and small cities. They quickly develop a great variety of land uses that presently become hopelessly entangled without apparent order or plan: dairy, truck, fruit and poultry farms; homes strung along the road; areas of big and little houses; retail business and service establishments; garages and filling stations; road houses and night clubs; amusement enterprises; large country estates; parks, churches, schools; public and private institutions; and in many cases, nuisance uses that the city banishes to the suburbs such as rubbish dumps, disposal plants, rendering plants, automobile 'grave yards', and the like.

This struggle for land in the fringe area is creating serious problems in the provision of many services - good water, satisfactory sewage disposal, fire protection, police protection, light, air and space, transportation, education, recreation and social services - all part of a long and still growing list.

As people press into these fringe areas and the varied mixtures of land use establish themselves, the effect on the community as a whole may be either beneficial or detrimental. Some mixtures are helpful to one another and go logically together, such as schools, playgrounds and homes; or farms, rural villages and rural parks; or forests, summer camps and hunting area. Other mixtures are inefficient and usually contain uses which are harmful to one another as, for example, business establishments mixed with homes; or industry pouring its noise, dirt and fumes into homes, schools and playgrounds.

Lacking a planned zoning ordinance, it is not logical to expect that these uses will group themselves in an efficient or a harmonious fashion. In fact, there is an overwhelming amount of evidence to show that in these fringe areas the pressure for space is so great that almost always the result

is a hopeless hodge-podge, creating a myriad of problems which can rarely be solved later and then only by prohibitive financial expenditures.

While the problems presented in the urban-rural fringe are presently the more dramatic, those that exist in the dominantly rural areas are none-the-less important. Nearly every township with even a moderate population has combinations of land use that it will recognize as beneficial, as well as mixtures that have proven to be harmful.

In these rural areas, the quiet and charm of a farm community and the stability of its land values are frequently upset by a mushroom sub-division; by straggling roadside developments; or by excessive or poorly located signs, gas stations and roadside stands. Many farmers have experienced the obnoxious and unhealthful effects of a nearby piggery using garbage collected from a neighboring town. Another problem common to many rural areas is the unwise use of sub-marginal land. People attempting to farm this land very often lack the necessary farming know-how. The combination of poor land and inefficient methods inevitably add up to a bare subsistence income for the individual attempting the operation, and a considerable expense to the local community, or the local school district.

The concept of rural zoning differs from urban zoning in two respects. First, while urban zoning is seriously concerned with the height, size and area of buildings, rural zoning is primarily concerned with the use of land; secondly, rural zoning differs from urban zoning in the degree of application. It will seldom occur that all of the urban purposes of zoning are important to one township. For instance, the cumulative cluttering up of the township highways may be its most pressing problem. To keep billboards, gasoline stations, hamburger stands and other such commercial structures in their proper place, a comprehensive zoning ordinance should be established. This zoning adapts itself

to either a complex or a simple situation and can provide intelligent direction for the growth of any community.

III. REGIONAL COOPERATION

In the study of planning and zoning, one need not go far before he realizes the desirability of the regional approach. Only in rare instances is there any logic in the location of political boundaries, and just as seldom is there any relationship between these boundaries and the planning problems being faced by the people of the area. It naturally follows that in order to make the jurisdiction of a planning or zoning commission coterminous with the actual problems, it is often necessary for two or more political units to cooperate in the formation of a joint or regional agency.

The legislation which authorizes two or more adjoining municipalities (as used in the act the word municipality includes cities of the third class, boroughs, incorporated towns and townships), to set up a regional zoning ordinance is contained in Act 159 of 1943, as twice amended in 1945 by the General Assembly.

Under regional planning and zoning procedures, the participating governmental units retain all their independent legislative functions. The joint agreement would merely set forth the particulars relating to the manner of cooperation including such things as the employment of joint personnel, the employment and retaining of planning engineers and consultants, the contracting for professional planning services and the purchase of personal property for the joint use of the participating municipalities. Any joint agreement shall be deemed in force when it has been adopted by ordinance or resolution.

The theory of joint action has long been accepted for the provision of services. Many special authorities have been created and given power to administer such things as water supply, sewage disposal, and public health

activities throughout two or more political units. Where political annexations or consolidations are desirable but unobtainable, the joint or regional agency offers an opportunity for the solution of common problems.

Armed with a joint agreement, townships would be much better prepared to deal with many of their land use problems. Rural townships with extensive sub-marginal land; urbanized townships with built-up areas extending outside their boundaries; and townships having commercial distrits whose patrons are drawn from a large area, would all profit from regional cooperation in their planning studies. A further advantage would be the important savings that would accrue to all participating units through the joint use of personnel and materials.

IV. METHODS AND PROCEDURES

One of the basic concepts of zoning as a principle is that it should be locally initiated and to a large degree locally supported. In order for zoning to contribute the fullest measure of direction to the future growth of the community it must be understood and wanted by the people whose future it will benefit. Consequently, it is essential that an expression of desire for the ordinance be obtained from the property owners in the township. For this, a program of public education and enlightenment often becomes necessary. This may develop from a number of sources, including public or private individuals or groups, through the medium of the press and radio, and through the programs of clubs, civic organizations and public schools. Petitions are often circulated, urging the appointment of a zoning commission and the adoption of an ordinance. It may be that the impetus for the program comes from the supervisors themselves, but they will find it much more apt to be successful if they obtain public understanding and support before the adoption of an ordinance.

When the township supervisors have appointed a zoning commission of five citizens, as stipulated in the enabling act, and made the necessary

appropriations for its operation, it is then the duty of such a commission to formulate a zoning ordinance and prepare a zoning plan for consideration and ultimate adoption by the township supervisors. The zoning plan or map will divide the township into the proper number and kind of use districts and the ordinance will set forth the regulations which will govern each district as well as the manner of administration of these regulations.

In drafting both ordinance and map it should be appreciated from the start that every township or region has its own particular needs and that the provisions of an ordinance for one unit may not be at all applicable to another Copying an ordinance that has been applied elsewhere is, therefore, not a safe procedure and may do more harm than good.

By the very nature of the process involved in drafting a sound comprehensive ordinance, it is not reasonable to expect any commission to carry out its program without technical guidance and assistance. Men trained in the field of planning and zoning should be called upon at the outset.

The size, population and existing characteristics of a township will determine the amount of studies necessary for a good zoning ordinance. Much of the following outline of studies is basic to all zoning programs - but some of the more detailed studies are unnecessary in rural, agricultural townships which are interested for the most part only in preserving their rural character and maintaining their present values.

The first step of the new zoning commission should be to ascertain, tabulate, and map all of the pertinent facts as to the existing conditions throughout and immediately adjoining the township area. Most of this factual data can best be shown in map form. One map should show all public and semi-public properties including: streets and roads, parks and playgrounds, schools, airports, railroads; together with such geographical features as lakes and

principal streams. Another map should show the existing use of private property for all kinds of business, industry, residence (single or multiple family dwellings) agriculture and forest.

The topographic map, giving detailed information as to the contour of the land, (available through the U. S. Geological Survey), is one of the most important base maps for planning preparations. Following the completion of this and other necessary base maps, a property line map should be prepared at the same scale showing all lot lines in the township. Prints and reproductions of this map are used as a base map for land use, land value, and housing studies.

By combining the information on air photographs with sufficient field checking, an accurate land use map may be evolved. This will serve as an inventory of all land parcels, both public and private, and of the exact use to which each is being put. This information is indispensable for the preparation of an adequate Master-Plan. Air photographs may be obtained at a reasonable cost through the State Planning Board and will more than ropay their cost in time saved and mistakes avoided. Earlier state-wide air photographs, some of which are now obsolete, are presently being replaced under a joint State-Federal program. These new, up-to-date air photos are now available for some counties and should be available for the entire State some time during 1951.

In addition to the information outlined above, there should be compiled and tabulated or mapped such physical data as a classification of streets and roads, listing their present and anticipated traffic loads, transportation desire patterns, accident spot maps and parking facilities; studies of other forms of transportation such as railroads, railroad terminals, truck terminals, street car and bus routes with time-zone maps showing areas served, water transportation and airport facilities and studies of the township water supply, sewage systems and surface drainage characteristics. These studies should be made of existing facilities, their adequacy and accessability, the need for future sites and their

size, location and correlation with existing improvements.

Because the township zoning program will be primarily concerned with the prople who live in the township, facts dealing with the population play an important role in a comprehensive survey. These social facts have to do with the numbers, natural increase, migration, source and character, age composition, occupation and economic status of the townships population. Health and welfare studies should also be made in connection with the population surveys. The above social studies, combined with studies of the factors contributing to the economic base of the community are necessary in order to determine the future population and the areas that will be needed in the future for housing, industry, commerce, civic buildings, schools, recreation, transportation and social institutions.

Once the maps are completed and the comprehensive planning studies have been made, the zoning commission has a thorough, factual foundation upon which to base its zoning plan. From these studies evolve the logical layout of the several "use" districts and the necessary regulations pertaining to each one.

The tentative community plan accompanied by the planning studies (from which the township zoning map has been evolved) should be held and further developed by the Supervisors as a guide for layout and programming future community improvements.

The law provides that after the initial draft of the zoning ordinance and map has been prepared, the Zoning Commission is required to hold public hearings at which all citizens are given an opportunity to be heard as to their views concerning the ordinance as a whole or as to its application to individual properties. Following these hearings the Zoning Commission should make such changes or revisions as seem advisable and submit its final report and recommendation to the Township Supervisors.

The Township Supervisors must proceed in turn to hold a further public hearing at which all interested parties are given opportunity to be heard. This hearing must be advertised fifteen days in advance in a paper of general circulation. Following this hearing the Supervisors may adopt the zoning ordinance in the same manner as for other enactments except that the full provisions of the ordinance need not be advertised as required in other cases, but may be supplied in summary form, or in the case of building code provisions, by reference to a typed or printed copy of the provisions of a standard Code. A certified copy of the adopted zoning ordinance and all subsequent amendments thereto must be filed with the County Recorder of Deeds before they become effective.

V. THE ZONING ORDINANCE

A comprehensive zoning ordinance consists of two parts: (1) a map showing the location of the various districts into which the township is divided and (2) a text setting forth the regulations that apply to each type of district and general information about the regulations and their administration.

The term district as used in zoning is often misunderstood. It is not meant to imply that only one area is set aside for each use, but instead there may be several areas throughout the township, all falling in one type of district - such as single-family dwelling areas.

As was mentioned earlier, some townships, being predominantly rural and having less complicated problems, will require a smaller number of use districts than the more heavily populated ones. Many townships will not require, and in fact should not have, more than three or four types of districts: one for agriculture, in which all usual agricultural and residential uses are permitted; one of concentrated residential use; one for business, in which the usual retail and wholesale commercial uses are permitted; and perhaps a fourth for industry. In setting up the classification, a safe rule to follow is that

there should be no more differing types of districts than seem necessary to accomplish local zoning objectives.

In the case of townships that have greater concentrations of people, and are more nearly urban in character, as many as six or more types of "use" districts may be desirable. In addition to the classifications of agricultural and single family residential, it may be wise to add a second residential district in which multiple dwellings would be permitted. Also, business uses might be divided into two districts; the first for local or neighborhood shopping facilities and the second for the more concentrated central shopping and business activities. In a community subject to the intrusion of heavy or obnoxious industrial uses, a second industrial classification may be needed. In cases where large areas of sub-marginal land exist, a district such as "forest-recreational" may be added.

Detailed regulations, including such items as front and side yard requirements, building heights, area coverages, construction requirements, and air and light stipulations, will appear in conjunction with each district classification. These details will vary with each local situation and can only be developed after complete planning studies. However, some generalization can be made concerning special or unusual cases.

Residential districts, being the highest or most protected use, will present the most problems. Part-time home occupations, such as dressmaking, sometimes mushroom into flourishing businesses which require additional space and the employment of several workers. Such remodeling for business purposes should be prohibited by a clause in the ordinance. Billboards, being business structures, may be prohibited from all residence districts. Special exceptions like hospitals, schools, churches, fire stations, which logically serve best in residence districts, are customarily permitted but their nuisance effects can be minimized by reasonable restrictions as to building, height, bulk, and location on the lot, as well as the minimum lot size and provisions for off-street

parking.

Since the districts in a comprehensive zoning plan will seldom, if ever, conform exactly to the areas of present land use, there will always be individual properties which do not comply with the regulations - as, for example, a grocery store in a residential area. Such non-conforming uses are usually allowed to remain, but under certain restrictions contained in the zoning ordinance. These restrictions usually include a limitation of the extent to which they may be enlarged and provide for their discontinuance following abandonment for a specified period.

The foregoing is intended merely as an outline of some of the principles to be observed and general procedures to be followed in the drawing up of a zoning ordinance. The field of planning, which includes zoning as one of its subsidiary activities, comprises just as distinct an art and science as do the professions of law, medicine or engineering, and is no more susceptible than are those activities to simple rule-of-thumb procedures that can be set down in a few words. This again emphasizes the importance of enlisting experienced assistance for this work.

A list of possible sections for a township ordinance might be as follows:

I. Interpretation and Purposes
II. Scope of Regulations and Map
III. Definitions
IV. Agriculture and Residence "A" Districts
V. Residence "B" Districts
VI. Business "A" Districts
VII. Business "B" Districts
VIII. Industry "A" Districts
IX. Industry "B" Districts
X. Exceptions and Modifications
XI. Administration
XII. Violations and Penalties
XIII. Repeal of Conflicting Ordinances and Date Effective

Following is a partial list of the more important mistakes usually found in the earliest zoning ordinances, which should be avoided throughout all

the stages of the local zoning program.

1. The zoning ordinance not prepared as a part of a comprehensive community plan.

2. Excessive amounts of area zoned for the more intensive uses, such as multiple dwellings and strung-out businesses.

3. Regulating non-conforming uses in a manner which tends to perpetuate rather than eliminate them.

4. Spot zoning, usually for business, comprising one or two lots instead of a district of sufficient size to satisfy the principle that zoning must be comprehensive in scope.

5. Wide differences in the zoning of opposite sides of the same section of street or intersection.

6. Extreme differences between adjoining districts, such as residence district abutting on a heavy industrial district.

7. Special exceptions such as utility installations, social organizations, or hospitals permitted in all residence districts without requirement of approval of the board of adjustment under adequate conditions and safeguards.

8. A "special exception" type of use permitted solely on the basis of neiborhood consent.

9. Construction of new dwellings in heavy industrial districts.

10. Inadequate safeguards covering boarding houses, rooming houses, and home occupations in residence districts.

11. No requirements for the provision of off-street loading and unloading space in business and industrial districts.

12. No provision for large-scale housing projects, subject to reasonable requirements.

VI. ADMINISTRATION AND ENFORCEMENT

The law provides that at the time the zoning regulations become effective "The supervisors may appoint a board of adjustment". While this provision is not legally mandatory, experience has shown that the appointing of such a board is imperative. As there may be individual pieces of land here and there in which, owing to exceptional characteristics, conformance to the district regulations might impose extraordinary hardship upon the owner, most

ordinances have customarily entrusted to the board of adjustment the power to ease up on the literal enforcement of the district regulations through the granting of a variance, when this may be done without violating the general objectives of the ordinance.

The powers of the board of adjustment include those of hearing appeals of alleged error in any order or regulations; of hearing and deciding requests for such special exceptions as are clearly provided for in the ordinance; and of authorizing variances, as mentioned above.

In order to prevent the Board of Adjustment from yielding to the temptation of gradually substituting a system of regulation by individual properties, the ordinance should carefully define the conditions which justify a variance and also specify the types of permitted exceptional uses, as well as the standards to govern such permissions.

To protect the integrity of the zoning ordinance it is important to understand the differences between a special exception and a variance. A special exception is a use, such as hospitals, clubs, off-street parking, etc., specifically listed in the zoning ordinance as being allowed in certain or all districts by action of the Board of Adjustment providing certain stated conditions are complied with. A variance, on the other hand, is concerned with departing to a minor degree from the terms of the ordinance in direct regard to a hardship peculiar to an individual lot. A variance is usually in connection with the extent of a land use, while an exception is more often concerned with a type of land use. An appeal for a variance is made to the Board of Adjustment, and if the Board is satisfied that the hardship is peculiar to the individual lot, it may be granted, providing always, that in making such variance, the spirit and purpose of the ordinance is preserved, and substantial justice done.

A complete understanding of the principles involved, together with the proper legislative provisions, will enable a wise board of adjustment to avoid much legal controversy and still preserve the intent and objectives of the zoning ordinance.

In connection with the operation of a board of adjustment, the law provides that any individual, after first exhausting the remedies afforded by such a board, may appeal his case to the court of common pleas.

As a means of administering the zoning ordinance, permits for initiating all land uses coming within the province of the zoning ordinance, should be required. It may also be desirable, as a check upon conformance, to require occupancy permits prior to the occupancy of any completed structure. In order to avoid unnecessary "red tape" in the requirement of permits, certain uses, such as farm buildings and farm lands, may be exempted from this requirement.

Some township employee or other person should be designated as the "Zoning Officer" by the board of supervisors and charged with the duty of issuing permits and of checking against ordinance violations. The Zoning Officer has no discretion in the matt r of issuing permits. If the building or use in question conforms to the ordinance, he must issue the permit. If the building or use does not conform he must refuse a permit and advise the applicant as to the steps to be taken if he wishes to make an appeal.

VII. AMENDMENTS

Pennsylvania enabling legislation does not require a periodic report or inventory of desirable revisions to the zoning ordinance as is the case in some states, and so it behooves the supervisors to call for a periodic examination of the ordinance to see that it is kept up-to-date. This they may do under the law by following the same procedure as in the enactment of the original ordinance.

While the theory of a regular check up on the regulations is highly desirable, much care should be exercised against a too frequent use of the amendment procedure. Too many spotty changes may quickly destroy the whole operation of zoning. A good safeguard, insofar as this is concerned, is a provision in the ordinance that all proposed amendments be referred to the zoning commission for report, prior to final action by the supervisors.

VIII. COURT DECISIONS AND LOCAL EXPERIENCE

In 1926 the United States Supreme Court (Village of Euclid, Ohio vs. Ambler Realty Co.) decided that the community has the right to exercise the state grant of the police power with respect to regulating the height, area, and use of buildings, and the use of land, providing the regulations are reasonable and have a substantial relation to the health, safety, morals, comfort, convenience and welfare of the people.

The general right of a municipality to zone has been supported by court decisions at all levels; however, the legal foundation of the complete body of zoning regulation has been gradually developed by court decisions relating to each individual aspect of the regulations.

Height and area regulations were the first to be recognized by the courts, on the general promise that more people need to be gathered together near the center of a population - and consequently buildings in the central area will have to be higher and closer together than in the outlying areas. An early case, establishing this principle was Atkinson vs. Piper - Wisconsin 1923. But the specific limitations of height and area in every district rests on many detailed considerations such as protection against fire, dark canyons between tall buildings, overloading of streets, etc. This interpretation came in Lake Building Corporation vs. Hamilton, Michigan 1930.

The courts began to approve 'use zoning' in 1925. Some early decisions hold that the exclusion of a store from a residence district was for esthetic

reasons and that the health and safety of the community were not affected. By gradual changes both in judicial opinion and enabling legislation, much progress was made and by 1927 the basis for 'use zoning' was well established as shown in the case of Cadillac Company vs. Christopher in Missouri. The boundaries of use districts have presented many difficult problems. Courts have been reluctant to hold that one side of a street can be retained indefinitely as a residence zone while the other side is zoned and occupied for business. This interpretation has logically led to the practice of establishing district boundaries at the back property line, within the block interiors. Also, in connection with boundary lines, it must be remembered that the fixing of such lines is a legislative function, and the local legislative body, not the board of adjustment (appeals) must officially adopt them (Massachusetts-Nelson vs. Town of Belmont 1931).

Population density was first regulated indirectly through building area and use requirements. In 1924 the New York Supreme Court decided in Barker vs. Switzer that the number of families per acre could not be regulated under provisions for area or use of buildings. The words "density of population" soon began to appear in enabling acts, including those of Pennsylvania, permitting municipalities to deal directly with the problems of overcrowding.

The changing needs of the community will sooner or later require that the zoning ordinance be amended. In many cases where this action has been neglected too long, the board of appeals has been tempted to overstep the bounds of their authority by issuing variances which in effect amend the regulations. As serious as the evil of allowing use variances is the vicious practice of "spot zoning". This amounts to a promiscuous use of the amending power to zone for special benefits and private gain. Zoning bodies should doubly guard against the practice of spot zoning, because not only will the

courts be loath to uphold such ordinances or amendments, but also the practice will soon render the whole zoning operation completely ineffective.

For the sake of an efficient zoning program it is all-important to delimit, insofar as possible, the power and duties of the board of adjustment. A great many zoning ordinances have been completely ruined by an unwise handling of appeals. A Pennsylvania decision (appeal of Costello, Comm. Pa. 93) holds that while the board of adjustment has a wide measure of discretion when acting within its granted powers, there is a limitation on its authority and hence it may not, by its decision, destroy the spirit of the zoning law. This is an important point which has been emphasized many times by the courts. Variances from the literal terms of the ordinance granted by the board in hardship cases should always satisfy the requirements that the general intent or spirit of the law remain undamaged.

The board of adjustment should be concerned fundamentally only with those matters relating to the real estate then under consideration and with the use to be made thereof, and not with the person who owns or occupies it. It is an ill-conceived zoning ordinance that merely seeks to protect what already exists - instead we should be zoning - as well as planning - for the future. Any zoning ordinance is open to the attack of individuals who yield to the temptation of short time, personal gain and if the ordinance is not built on a solid, factual, forward looking foundation, it will permit unhealthy growth to occur and soon become enmeshed in unfavorable court decisions.

IX. PLANNING POWERS OF SUPERVISORS

Pending the passage of more adequate enabling legislation, it might be well to explore the possibilities that presently exist for second class township supervisors to exercise planning powers. Under the present law, the zoning commission may terminate its activities at the time of enactment of

the zoning ordinance with the exception of possible recall for the purpose of considering zoning amendments. In many instances, the wisest course for developing a township plan may be the continued existence of the zoning commission, ostensibly to advise the supervisors on zoning amendments, but actually, to assist them in matters of planning in the township, and to further develop the planning program.

As an alternative to this, the planning studies which resulted from the zoning commission's work can be taken over by the supervisors. Whether or not these studies (from which a community plan might be evolved) prove to be beneficial, will depend largely upon the quality and quantity of the added effort on the part of the supervisors, that is put into their continued development. As our attitudes, policies, and habits change so, of necessity, will our plans for the future. The job of constantly amending the master plan must be done by the supervisors - if any value is to be gained from the practice of planning.

The supervisors are also responsible, in the absence of a county planning commission, for the acceptability of subdivisions. Herein lies a very important part of planning power. When a subdivision is laid out, the pattern of that particular area becomes frozen for many future decades. Future changes will no doubt be prohibitive in cost, so it behooves whoever has the power of approval to be sure that, first, the best available planning principles are followed in the actual layout and second that the subdivision in question is actually needed and will not lead to a costly tax delinquency problem. In many localities, the increasing population, caused by the rapidly expanding subdivisions, has brought tremendous burdens upon the local governments and school boards. The increased income from taxes is far overshadowed by the cost of providing educational and municipal facilities for the new citizens. One of the controls over such a situation is maintaining a lower population density through carefully planning subdivision regulations.

On May 24, 1951, the Governor signed into law, Act No. 85 of the 1951 Session of the Legislature. This Act authorizes the board of supervisors in all Second Class Townships to adopt by resolution land subdivision regulations. The powers available under this new law are quite similar to those long held by other types of municipalities in the Commonwealth, with the exception that, as in First Class Townships, the adoption and administration of the regulations must be accomplished by the governing body rather than by a planning commission. Such regulations may include definitions, design standards, plan requirements, plan processing procedures, improvement construction requirements, and conditions of acceptance of public improvements by the township.

The Act itself specifically defines subdivision as "the division of a single lot, tract or parcel of land or a part thereof into two or more tracts or parcels of land". . . . "provided, however, that divisions of land for agricultural purposes in parcels of more than ten acres not involving any new street or easement of access shall be exempted."

Another new planning tool made available to Second Class Township supervisors by Act No. 85 is the power to adopt building codes. While these new powers, together with the authority to zone, provide townships with important tools to meet specific problems, it should not be forgotten that their isolated application without good sound planning will produce little. An outline of generally acceptable subdivision standards may be found in the last section of this chapter and a short resume of the provisions of Article 12A of the Second Class Township Code appears in the Supplement.

Public improvements of all kinds will be more efficiently and logically situated if each one is carefully planned as it relates to the whole community. Such mistakes as schools being built in areas where there will soon be a decline in children of school age will be avoided if population planning

studies have been carefully applied. The community can benefit greatly and in many ways if the supervisors will make use of the planning studies and diligently apply their best efforts toward keeping their plan up to date.

Proper use of the planning tools and methods herein described are by no means limited to built up urban areas, but may well be applied in many rural and semi-rural townships. Townships of the second class are confronted with future growth problems fully as serious as those that presently exist in boroughs or first class townships and it is only logical that second class townships should be given the opportunity to equip themselves with planning commissions. The simplest method of accomplishing this would be a revision of the present Second Class Township enabling legislation, a proposal which failed to pass the Legislature in the last several sessions. Every effort should be made to inform the public of the need for a planning program. Citizen groups, in turn, could be instrumental in securing the necessary legislative changes.

X. PLANNING AS A PROCESS

While there is no specific law authorizing a public planning body in second class townships, neither is there anything in the law preventing the township supervisors from availing themselves of the advantages and benefits afforded by planning as a practice. The institution of planning policies in any local community need not depend on widespread support at the beginning, but may rather be the result of intensive action on the part of a handful of civic-minded, forward-looking people. Where the initial impetus comes from is not as important as the fact that such policies are adopted as a part of the day-to-day administration of the local government. Any number of plans may be made - any number of goals may be established - but unless there is cognizance of the planning function in the government process, the planning effort will be valueless. Township supervisors can adopt a policy of community development, using

as a basis the planning studies which were made as a background to the zoning ordinance.

In many instances, a group of citizens, acting in a private capacity have proven of value in plan development for a locality. The effectiveness of such organizations often depend on the soundness of their recommendations, the method they use in presenting their work to the governing body, and the weight they carry in the community. The work of such organizations is very often accepted with gratitude, for it is a rare council or board of supervisors who fails to recognize goals and aims established for the public good. Groups established for this very purpose, civic improvement groups, recreational organizations, social organizations, and sub-committees of such groups as the local Chamber of Commerce are all excellent examples of private organizations which may help in this work. The active participation of such groups might well be the key to a continuing planning process. In many cases, the members of these organizations are in a much better position to think objectively about the future of the community than is the elected official who usually concerns himself with short term economics, looking ahead to the coming election.

XI. PLANNING STANDARDS

In order to help clarify what is involved in the operation of the planning process, some indication of the scope of the various sets of planning standards should be made. For purposes of planning space requirements, standards relating to education and recreation should be considered in close connection with each other, since the design may be affected by the combination of uses.

Consideration should also be given to the other elements that go to make up the complete community. Such things as shopping centers, industrial areas, public facilities and large public open spaces should be studied, both as to their individual needs and also as to how they fit into the overall plan.

General principles applying to the location of all elements are:

1. To meet the standards of safe access between dwellings and neighborhood and community facilities.

2. To encourage the fullest use of all community facilities by the residents.

3. To establish focal points in the neighborhood and also in the community that will stimulate the growth of vital community relationships.

4. To avoid nuisances and hazards to residences.

5. To produce the most efficient and economic land use pattern, and to avoid unnecessary duplication of facilities.

Space requirements will vary in every local situation. Only average figures can be given which show the percentages of land devoted to the various community uses and at best these can only be used as a check in any particular locality.

It is generally agreed that by the application of modern planning principles, the amount of space heretofore devoted to streets may be greatly decreased, thereby providing a larger amount of living, working and playing space. In the normal older city, streets take as much as thirty-five (35) per cent of the total area, leaving only sixty-five (65) per cent to be divided among dwellings, public open space, commerce and industry. This sixty-five (65) per cent is usually distributed roughly as follows: dwellings - forty (40) per cent; community facilities and open space - thirteen (13) per cent; commercial area - three (3) per cent; industry - nine (9) per cent. In the layout of new areas, however, the percentage of area devoted to streets can often be reduced to twenty (20), thus providing fifteen (15) per cent of the total area to be added to other uses. In townships where concentrated population exists, land use requirements will run fairly close to those of cities, with the probable exception that there will not be as much land needed for industry. In many cases then, townships may be able, in developing higher

density areas, to devote from forty-five (45) to fifty-five (55) per cent for dwelling space; from fifteen (15) to twenty (20) per cent for community facilities and open space; from five (5) to seven (7) per cent for commercial areas (providing for greater off-street parking); and from three (3) to five (5) per cent for industrial use.

Subdivision regulations should be designed to assure the orderly development of residential areas, the coordination of existing streets and public utilities with new extensions, the proper provision of open space for passive and active recreation and the proper location of future sites for schools, public buildings and shopping areas. In order to attain this purpose, complete subdivision regulations must be concerned with the land, streets and roads, blocks and lots, building lines, utility easements and the provision of improvements such as sidewalks, planting, water mains, sewers, and monuments.

The suitability of the land for the proposed subdivision should be the first consideration. Land subject to flooding should be deemed uninhabitable by the board, and not platted for residential occupancy, or for such other uses as may increase danger to health, life, or property. Such land may well be reserved for certain uses which will not be endangered by periodic inundation. Topography and soil types should also be considered as they will affect desirable circulation patterns and population densities.

In order to clarify the standards pertaining to streets, a classification of street types is necessary. Local residential streets (residential service streets) are normally defined as those providing direct access to residential structures and serving only a comparatively small number of dwellings. Secondary streets (neighborhood feeder streets) are those serving only neighborhood traffic and which connect service streets to each other, to local facilities and to primary or major traffic streets. Primary or major

thoroughfares are those streets or roads connecting district centers, serving large volumes of through fast-moving traffic and which are preferably located outside or on the boundary of neighborhoods.

The circulation pattern for a new subdivision should conform generally to the over-all community plan. Provision for the extension of major streets into and from adjoining areas should be required, while local service streets should be so designed as to discourage through traffic. If the proposed subdivision is adjacent to a primary or major thoroughfare, provision should be made for necessary future widening, as well as marginal interceptor streets running parallel to the thoroughfare.

If culs-de-sac (dead end streets) are used, lengths up to 600' are generally considered acceptable, provided the cul-de-sac is amply wide for two lanes of traffic unobstructed except by occasional parking and provided there is a turning space with a diameter of at least eighty (80) feet at the end, for heavy service vehicles. Where minor streets near each other open into opposite sides of a major street they should be made to coincide, making for fewer intersections and easier traffic control. Intersections along primary or major thoroughfares should not occur at intervals of less than eight hundred (800) feet.

The first specific subdivision standards to be considered are those relating to street or road alignment. Curves should be designed with both the desired vehicle speed and adequate sight distance in mind. A good minimum radius at the center line for curves on primary roads is five hundred (500) feet; for secondary roads three hundred (300) feet; for local service streets one hundred (100) feet. Sight distances (both horizontal and vertical) should be four hundred (400) feet for primary roads; two hundred (200) feet for secondary roads and one hundred (100) feet for service streets. Proper super-elevation should be provided for curves of less than six hundred (600) feet

radius om primary and secondary roads and for curves of less than three hundred (300) feet radius on service streets. A tangent of at least one hundred (100) feet should be provided between reverse curves.

The controlling factor in street grades is safe descent. However, desirable street grades depend also upon type and volume of traffic and upon weather and pavement conditions. A maximum of six (6) to eight (8) per cent is usually recommended for residential streets under normal conditions, with a possible maximum up to ten (10) per cent for very short distances. Grades up to six (6) per cent are allowed on major streets. A minimum street grade should also be stipulated (usually one-half (0.5) per cent) in order to insure adequate drainage. Vertical curves should be provided for all grade changes exceeding one (1) per cent, and intersections should be approached on all sides by leveling areas.

Many suitable combinations of pavement width are possible, depending upon the speed of traffic, provision for curb parking, etc. However, some generalizations can be made. Ten (10) feet is considered as the minimum width for a lane of moving traffic, with eleven (11) or twelve (12) feet being recommended for higher speeds. Eight (8) feet is the standard width of a lane of parallel parking. The minimum width of pavement then, on a one-way service street with two parking lanes would be twenty-six (26) feet; on a secondary feeder street with two parking lanes thirty-six (36) feet would be required. Where planting strips and side walks are to be incorporated, an additional twenty-four (24) feet should be included within the right-of-way.

Standards for intersections should prohibit the junction of more than four roadways, require right-angle intersections along major streets, and prohibit service streets intersection angles of less than sixty (60) degrees. Turning radii should permit right turn by vehicles so that they will not cross the center line of roadway being entered.

Flexibility in block size is of extreme importance. Local practices, topography, drainage and many other factors may influence the size of the individual block. Recent subdivision practice has begun to recognize the existence of the automobile age, and the result is longer, larger blocks. These lead to economy for the developing and the municipality and should be encouraged wherever feasible. Allowing room for modification, a minimum block length may be set at five hundred (500) feet and a maximum at fifteen to eighteen hundred (1500-1800) feet. Large scale multiple housing developments and commercial sites should be recognized as just causes for deviations from these requirements.

Lot sizes often provide a better bone of contention, since narrow frontages are important to the developer and broad lots are usually desired by the community. However, it should always be remembered that the most important economy lies in the provision of decent living conditions for the future. In addition, the increased road and improvement costs entailed by the provision of wider lot fraontages may often be entirely offset by a decrease in lot depth and proper planning of block arrangements and utility systems. Since local conditions vary greatly, minimum standards cannot be universally applied. However, in many communities, the suggested minimum width of sixty (60) feet and areas of seven thousand (7,000) feet and ten thousand (10,000) square feet may be suitable minimum for the suburb.

The types of water, sewer and drainage facilities that the developer should be required to provide will vary with the character of the site and the availability of public water and sewer mains. In semi-urban areas where public water and sewer mains are not available within a reasonable distance, the developer might be required to install water and sewage disposal facilities that will meet local health standards. In order to insure a healthful separation of water supply and sewage disposal in such situations, lot sizes will necessarily

be much larger than when off-the-lot mains are installed. Desirable lot dimensions will vary with the type of soil and its percolation capacity. If the lot size required to provide adequate separation of water supply and septic tank is too great, the developer may find that the resulting smaller number of saleable lots will offset any advantage of individual installations. In fact, he might well be money ahead to provide off-the-lot sewerage at the outset.

In those instances where extension of public mains to or near the site is contemplated in the near future, the developer and new owner will probably find it more economical to install the local mains and connections within the subdivision at the time of development and to provide a temporary community water supply and sewage plant. The cost of any sewage installation is not complete until connection has been made with the public system. Consequently, if the laterals and local mains of a community plant were initially used, part of the cost of the public connection will have been saved; if, on the other hand, cesspools or septic tanks were originally installed nothing can be salvaged - the property owner will have paid twice for the same service.

In any event, local development regulations should demand profiles and cross sections of all streets (including drainage facilities), water supply and sewage lines - to be approved by the local engineer, or in his absence by a competent civil engineer, before the proposed plat is accepted. The proper design and installation of these facilities depend upon close cooperation between developer, planner, engineer and the health authorities.

The conformance to building lines are important in obtaining sufficient front yard space, adequate sight distances on street curves and at intersections, and space for future street widenings. Modern living habits, however, place a greater emphasis on the rear yard, leading, in many cases to smaller minimum set-back lines. Each local situation will demand special

consideration - minimums may range from twenty-five (25) feet to sixty (60) feet.

Alleys are often more of a liability than an asset in residential areas, and their use should be kept at a minimum. An alley may be justified when used as a rear access to lots fronting on a major thoroughfare, or in commercial developments where special loading areas have not been designed. Where used they should be wide enough to allow the passage of large service vehicles - from eighteen (18) to twenty-two (22) feet.

The use of easements (a right granted to use certain land for a special purpose not inconsistent with the general property rights of the owner) along the rear property lines are usually recommended for the installation of gas, water and sewer mains, and telephone and electric wires. Where easements can be obtained they should be of sufficient width to insure accessibility by repair equipment. Suggested minimum widths are from five (5) to seven (7) feet from the rear of each abutting lot.

Probably one of the most important factors in making the neighborhood the kind of social unit it should be is the educational system and program. In making planning studies, it is desirable to think in terms of an educational and recreational program for people of all ages rather than of mere school buildings and playgrounds where children may be accommodated. At the present time more than fifty-five per cent of our population is over twenty-five years of age and, with the rapid advances being made in the medical and social fields, this percentage will grow steadily larger. The conspicuous lack of education and recreation suitable for our adult population is becoming increasingly evident, and although the State legislature has enacted laws authorizing communities to provide adequate programs and facilities for people beyond the school age, so far there has been a minimum of activity on the local level.

These enactments are included in the Second Class Township Code and in the Public School Code. The law provides for coordination and cooperation between the townships and the school districts, often a wise move - preventing duplication of effort and expenditure.

The planning agency of densely populated or rapidly growing townships can and should provide much valuable assistance to the school districts with respect to future needs of both the educational and recreational programs.

The educational facilities to be supplied within the normal neighborhood include elementary schools, and kindergarten and nursery schools. Junior and senior high schools and most types of adult education should be provided on a district basis because of the larger population required for their support, and because the portion of the population which they serve extends into several neighborhoods - and sometimes covers the entire community.

Many school authorities recommend, especially where new construction is taking place, that the grade separation follows the 6-3-3 plan. Where only six grades are included in the elementary school, one wing of the building might well be designed to care for the nursery and kindergarten ages. Educational authorities recommend that nursery schools have not more than fifteen (15) pupils per adult supervisor.

In kindergarten and elementary schools it is generally agreed that there should be a maximum of thirty (30) pupils per classroom. This would indicate a possible school population of one hundred eighty (180) in a minimum six grade school. However, from the standpoint of administrative efficiency, four to eight hundred (400-800) pupils are recommended, and the larger unit should be considered in built-up areas where walking distance requirements can be met.

The neighborhood playground should be combined with the elementary school where possible. When school and playground are combined the site should

include at least five (5) acres. This will range up to eight (8) acres for a four hundrod (400) pupil school. Area requirements for junior high schools are usually between ten (10) and twenty (20) acres.

In order to offer a siffucient range of courses, junior high schools should range in size from seven hundred fifty (750) to fifteen hundred (1500) with a maximum classroom capacity of thirty-five (35); senior high schools should have a population of from one thousand (1000) to two thousand (2000) with a maximum classroom capacity of forty (40). In sparsely settled areas such school sizes as those suggested above will be out of the realm of possibility, even with a well-organized consolidation program. In such situations an optimum compromise must be made between the school size and distance factors.

In order to plan for necessary school and recreation facilities some assumptions must be made as to future population figures. In a planned area the future number of dwelling units will be known. Using an average family size of 3.6 to 3.8 persons, the ultimate total population may be computed. Based on national averages, for every one thousand (1000) people there will be approximately thirty-seven (37) children of nursery school age; fifteen (15) children of kindergarten age; ninety (90) of grade school age; thirty (30) of junior high school age; and thirty (30) of senior high school age. The foregoing data should be used merely as a guide. School policy, community traditions, income status, pupils attending private schools and other factors must be given careful consideration in each local situation.

With respect to travel distances, the following rules are suggested as a guide: Children of pre-school age should not be required to walk further than one-quarter ($\frac{1}{4}$) mile; those of elementary school age not farther than one-half ($\frac{1}{2}$) mile; those of junior high school age not further than one (1) mile. Wherever possible children should not be required to cross grade

railroad lines, heavy traffic arteries, industrial districts or commercial developments.

SUGGESTED SOURCE MATERIAL

American Public Health Association
Planning the Neighborhood
R. R. Donnelley & Sons - 1948

International City Managers Association
Local Planning Administration - 1948

Pennsylvania State Planning Board
Planning and Zoning Powers and Procedures
Volume 1, 1949 (Regions, Counties, Townships of the Second-Class)
Planning and Zoning Powers and Procedures
Volume 2, 1950 (Regions, Cities, Boroughs, Townships of the First-Class)
Planning and Zoning Powers and Procedures
Volume 3, 1948 - The Pennsylvania Zoning Primer
Planning and Zoning Powers and Procedures
Volume 4, 1948 - Local Powers for Community Development
Planning and Zoning Powers and Procedures
Volume 5, 1950 - The Recreation Manual

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PLANNING AND ZONING

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PLANNING AND ZONING

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VOLUME II

REVISED EDITION

STATE PLANNING BOARD
PENNSYLVANIA DEPARTMENT OF COMMERCE
HARRISBURG, PENNA.
1950

THIS TEXT *is a revision of the series on Planning and Zoning Powers and Procedures, originally prepared by Russell VanNest Black with the assistance of members of the State Planning Board staff. The first edition has been widely distributed.*

Changes in the enabling acts have made necessary this revision, which is not designed to provide an exhaustive text on the various phases of local planning, but rather to acquaint the reader with the basic purpose, principles, and practice in a field which becomes of increasing interest and importance every year.

Specific questions in regard to local problems may be addressed to the State Planning Board of the Department of Commerce.

A list of the more recent publications of the Planning Board, including "The Pennsylania Zoning Primer" and "Local Powers for Community Development", will be found on the inside back cover of this publication.

A Bibliography of recent general publications on Planning and Zoning will be supplied on request.

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FOREWORD

Planning and Zoning are not new activities of government, nor is it a new principle that ownership does not confer absolute rights to harm others through the use of one's property. The social responsibility in the ownership of real estate is clearly recognized in the Code of Hammurabi, 2200 B. C.

Planning has a long and honorable history. It is almost as old as urban life itself. The first known town planner, Hippodamus of Miletus, born 480 B. C., "Introduced the principle of straight wide streets, and first of all architects made provision for the proper grouping of dwelling houses, and also paid heed to the combination of the different parts of a town in a harmonious whole, centered around the market place." [1]

The Greeks, the Romans, and the Italians of the Middle Ages developed and adapted the Greek traditions. The English in the reign of Edward I (1239-1307) held the first recorded conference of town planners, a group of fifty "wise men of the most knowing and most sufficient who knew best how to devise, order, and array a new town to the utmost profit of the King and the merchants." [1] The profession of planning is, therefore, a very old one, and its necessity has long been recognized.

Here in America, Penn's plan for his city on the Delaware and L'Enfant's plan for Washington established traditions and patterns adequate for their time, but not always fortunate for the future. Penn's plan, which became the typical American checkerboard pattern, lacked adequate provision for radial highways, and lim-

[1] Patrick Abercrombie, "Town and Country Planning."

ited street widths to the requirements of horse and wagon. L'Enfant's provided so many radial avenues that building areas were of inconvenient shapes and sizes, and traffic congestion has become a very serious problem.

From such experiences as these, however, the modern art and science of town planning was evolved. The rapid development of industrialism and of motor vehicle transportation, with the consequent growth of urban communities, has greatly enlarged the responsibility of planning, and has given it a strong economic slant. The mobility of modern life has carried far into the countryside the typical urban problems of traffic density and has emphasized the conflict among residential, agricultural, commercial, and industrial land uses.

Planning in America at every level has of necessity taken the form of dealing with the unexpected and often deplorable consequences of rapid urban and suburban growth, with the encouragement of economic development to support an increasing population, with the provision of adequate facilities properly located to be of maximum public use, and with the hard fact that 33,000,000 automobiles and 7,300,000 trucks and buses now travel our Nation's highways.

Planning is an attempt to make the best possible use of every advantage of location, resources, or facilities available to a community, to adapt new developments to the established trends of growth, and to overcome, so far as possible, any unnecessary handicaps resulting from changes in the patterns of transportation, in the character of neighborhoods, or in community needs not foreseen in the past.

Zoning, on the other hand, is primarily a form of conservation. Its aim is to preserve the values created in every community through the efforts of the present and earlier generations, to maintain the quality of community living and to prevent the useless dissipation of the residential, commercial, or industrial advantages on which the community's growth has depended, and upon which it must depend in the future.

It is, therefore, an important and necessary instrument for making effective both urban and rural plans for orderly development and growth.

The waste arising from the decay of established neighborhoods is as real a danger as soil erosion or the depletion of our forests by clear-cutting or fire. The invasion of uncontrolled commercial developments into residential neighborhoods is estimated to have cost the city of New York, before the application of its first zoning laws, a property loss of over a billion dollars a year—far greater than the annual fire loss of that great city.

In many of our smaller communities great harm has been done through the sacrifice of that security in the character of a property which is essential for stable or enhancing values.

Zoning, however, is only one of the several devices by which a community may direct its development along desired lines. The enforcement of sanitary and building codes, the control of subdivisions, the provision of proper facilities for residence, business, or industry, are all fully as important as any restrictive measures aimed to prevent a single land-owner or group of owners from destroying the character of a neighborhood for immediate profit.

Zoning depends for its effectiveness on a developed plan, and the success of a plan for a community's future depends in its turn upon the purposes on which the citizens of the community can agree. For this reason public opinion must be aroused and must emphatically express itself before any program of planning and zoning can be successful.

Leadership can crystallize a community's pride in its character and make it articulate. It can bring common sense to bear in achieving the community's purpose, but no sound community plan or zoning ordinance can be successfully imposed from above. At every point in the planning and zoning process the community should have an opportunity to express its will. The community plan and the zoning ordinance can only apply the best experience and skill available to carry out the community's will to the utmost advantage of all its people.

While the planning enabling laws of Pennsylvania emphasize the preparation of plans for the physical growth and development of their community, it has been evident for a number of years that a successful local plan must also be concerned with the growth of the community's commercial, industrial, recreational and cultural resources, and the development of conditions under which those resources may be put to the maximum use. It is not unlikely that legislation will soon specifically emphasize the powers of planning bodies to consider such factors and to prepare programs for the development of local resources and the promotion of local industry. Meanwhile many active planning bodies have already undertaken such a responsibility to the great benefit of the areas in which they operate.

PLANNING AND ZONING
POWERS AND PROCEDURES

VOLUME II

Cities, Boroughs, and Townships of the First Class

CHAPTER I

Progress and Objectives

Pennsylvania cities were among the very first in the United States to undertake comprehensive planning. Philadelphia had a well-established city planning department more than twenty-five years ago. One of the most frequently cited early city plans is William Penn's Plan for the "Quaker City." A Philadelphian was among the very first proponents of zoning. The Pennsylvania law for the establishment and protection of the official city plan grows out of an act of the Provincial Council in colonial times.

Historical Retrospect.

Planning vision appears to have lapsed early in the eighteen hundreds. A form of the official city plan law was retained in Pennsylvania but there is little evidence of continued attention to comprehensive city planning. Vision not only lapsed but went into reverse. Old turnpikes planned and laid out at six-rod widths were reduced to sixty-six feet and, then, some of them, cut again to thirty-three feet. Wheat and corn land were more important than idle acreage in roads. The horseless carriage had not yet appeared and few were the trips to town.

The automobile, industrial expansion, rapid city growth, and the increased cost of the more elaborate city improvements of the early nineteen hundreds forced attention once more upon the need for planned order and foresight in the building of cities. The Chicago World's Fair of 1893 demonstrated the architectural values that might be

achieved by conscious civic design. By 1925 there had been organized and there were actively at work in Pennsylvania thirty-eight municipal planning commissions. Regional planning was under way in the Pittsburgh and Philadelphia Metropolitan Districts. Sixty-nine municipalities had adopted zoning ordinances. It cannot be said that city planning was in full flower when the depression struck in late 1929, but distinct progress was being made and prospects were good.

Strangely, for those who see in planning a process for public economy, the depression fell like a blight upon city planning,—more so in Pennsylvania even than in many other states. It seemed not to have occurred to municipal administrations that cities as well as individuals must plan more and not less when income is reduced. Not only did the creation of new planning commissions virtually stop but most existing commissions were forced, by lack of working funds, either into inactivity or into work quite foreign to comprehensive and long-range planning.

At the time of the publication of the first edition of this Volume in 1938, there were only 69 local planning commissions in Pennsylvania. This number has increased to 130 official bodies, including those of four counties. The total number of the State's communities having planning or zoning, or both, is now 337. Not all of the existing commissions are, however, actively at work.

Considering the rapid increase in population during the 1940's, much of which has concentrated in our urban communities, far too few of the civil subdivisions of the State are providing adequate foresight as to their future progress, or adequate protection to their existing property values.

Zoning, like planning, is most likely to be adopted only when conditions have become so serious that action has grown imperative. Unfortunately, neither planning nor zoning operates most

effectively after the harm has been done. Their most important function is to prevent the development of conditions which are detrimental to community living, and to provide facilities in the proper locations to make more appealing for residence, for industry, or for commerce all the advantages in which a community can take pride.

As of the date of this publication, 58 per cent of Pennsylvania cities have established, or are preparing to establish, zoning protection, 57 per cent of all first class townships, but only 17.8 per cent of our boroughs, 4.5 per cent of our counties, and 4.6 per cent of our second class townships.

While this record is evidence of substantial improvement during the past ten years, it is far below the level of our need, if Pennsylvania is to maintain its high position among the American states in its attractions for residence, in the contentment of its workers, and in the opportunities provided for its business and industry.

Nature of Immediate Problem.

Two jobs, therefore, now confront the municipal planning of this Commonwealth: (1) the revitalizing of existing planning commissions; and (2) the establishment of new commissions where needed. This manual is intended to draw attention once more to the importance of city planning and to explain briefly why and how planning should be done.

What Municipalities Should Plan; When and Why?

Every municipality that does not contemplate shutting up shop and moving out every one that continues to spend money for public improvements should plan. Alterations in the old city structure as well as any necessary expansion can be achieved better and more economically if carried out in accordance with a city plan. Prospects of large growth are not a prerequisite to effective planning. Cities never stand still. Population growth may stop but obsolescence, changes, and rebuilding go on. The "old" is seldom so good but that it can be improved in the "new". Prosperity lends in-

centive to planning but impoverishment increases its necessity.

When to plan?—the sooner the better. It is never too late to start. It is sometimes said of a particular city, "Planning might have accomplished something fifty years ago but not now." What is fifty years in the life of a city? In the course of the next fifty or one hundred years every city in Pennsylvania will be virtually rebuilt. Shall the citizens of Harrisburg, Lancaster, and Altoona say in 2000, "What could not have been done with this city by the use of a little foresight a generation or two ago?"

Why plan?—for the same reason that private individuals and industries plan their activities,—in order to avoid unnecessary mistakes and to insure that the greatest and most enduring value is received for every dollar spent. Municipalities have the further incentive of insuring good residential environment and of achieving a civic structure agreeable to and convenient for the conduct of business and manufacturing.

For many years cities were allowed to develop "naturally", without centralized long-term guidance, partly because expansion was often imperceptible and partly because there seemed to be so little that could be done about it. Individual items of growth and change seemed of little importance. Seldom was their cumulative effect observed. Also, life in cities was relatively simple, and necessary improvements were relatively inexpensive. There were no automobiles to congest too-narrow streets; few hazards and nuisances to destroy residential neighborhoods; no necessity for elaborate and expensive street paving and costly street widenings; and no congested highway travel to encourage the miscellany of misplaced garages, gasoline stations, and hot-dog stands. Mistakes in the location or width of a street, and failures to set aside sufficient space for parks, school-grounds, and other public necessities were not so costly then as now, either in

lost comforts and conveniences or in dollars expended.

Occasions for Planning.

All that is changed. City building is a more serious business, and proceeding without benefit of plan is too costly. Cities that make of themselves good places in which to live and to do business, and accomplish this by business-like planning and without burdensome taxation will enjoy healthy growth and prosperity at the expense of more short-sighted communities.

Now there is developing a new and important need for planning: that of preparing the way for new large-scale housing, both public and private. Those who should know, claim that this country needs from eight to ten million new houses. Any considerable advance upon so large a building program will mean the rebuilding of large parts of many cities. In the light of present knowledge of how to build cities better adapted to present-day requirements, there can be no excuse for overlaying the old misfit and wasteful street pattern with new houses. City planning and city plans are needed to direct the location and to guide the form of the new housing projects.

For some decades, large-city growth has been spilling over into outlying territory, into the municipalities at the fringe of the larger cities and metropolitan areas. This "fringe" growth is likely to continue. Municipalities at the fringe are in special need of planned guidance and protection.

There is much talk of long-range programming and budgeting of capital improvements and capital expenditures. Such anticipation of and prearrangement for financing a balanced schedule of public improvements would seem to be only a business-like procedure. But intelligent programming and budgeting of capital improvements over a period of years can be done only by reference to a carefully worked out city plan showing all of a city's development needs in their relation to one another.

There seems to be no good reason for not planning. There are a multitude of benefits to accrue from doing it. Planning will not prevent all mistakes. Not all contingencies can be foreseen. But any intelligent foresight is better than the blind following of the paths of chance. Least of all should the cost of planning be a deterrent to planing. The cost is never prohibitively high and is always insignificant in comparison with savings effected over a period of years. The great cost is not in planning but in the failure to plan.

How To Go About Municipal Planning?

The actual city planning job is a specialized technical procedure requiring the help of trained and experienced personnel. This procedure cannot be set forth effectively in any book, certainly not in so brief a presentation as this. In the following chapters, however, an attempt will be made to explain the several steps to be taken in organizing for planning; the functions of planning and zoning commissions; and general procedures to be followed in carrying through a planning and zoning program. The following discussion is confined to planning and zoning for boroughs, cities, and townships of the first class.*

Community Individuality.

A first principle in plan making should be recognition of community individuality. Community goals, policies, and possibilities should be predetermined and consistently adhered to so far as is practicable. Localized ambition should be based upon the reality of local possibilities and should be reflected in the city plan and in the various planning controls. A plan so adapted to local conditions and goals will be both easier to carry out and financially and socially more advantageous.

* Planning and zoning procedures for counties, for townships of the second class and for groups of municipalities have been already covered by Vol. I of this series.

Chapter II

MUNICIPAL PLANNING PROCEDURES AND PRINCIPLES

Planning procedures and underlying principles are generally similar for all urban territory and for all municipalities regardless of size. Chief variances in the actual planning job are in the range and complication of planning problems. The most important variations in procedures are administrative and are determined by the individual state enabling acts. In order to avoid legal difficulties in plan administration, great care should be employed to make certain that the several planning steps,—from the creation of the planning commission onward,—are strictly in accordance with enabling legislation. The several Pennsylvania municipal planning enabling acts will be briefed in Chapter VIII.*

There are two somewhat different but closely related functions in municipal planning: one, the making and adjustment of plans, requiring specialized technical skill; the other, the critical approval and administration of plans requiring well balanced judgment and informed knowledge of local requirements and possibilities. The former is properly the function of the technical staff employed by the planning commission. The latter is the normal function of the planning commission itself. In practice, a close interplay of both functions is essential to effective results.

No attempt will be made here to produce a handbook on city planning or to draft a formula for doing the technical job of planning.

That is no more feasible for planning than for many other broad professional undertakings. But

* Full text of these acts is contained in the Appendices. Close reading of the full text of respective enabling acts should precede performance under these acts.

PROGRAM FOR PLANNING COMMISSIONS IN CITIES; BOROUGHS; AND TOWNSHIPS OF THE FIRST CLASS

The municipal governing body appoints a planning commission, or assigns the planning function to a park commission or kindred agency.

The municipal governing body provides the planning commission with working funds.
The planning commission organizes, employs staff and technical assistance and after making basic studies and surveys, prepares a comprehensive municipal plan.

The municipal governing body enacts ordinances adopting maps and plans, and thereafter, refers all project proposals for public improvements to the planning commission for report and recommendation.

The planning commission adopts platting regulations; exercises platting control authority over land subdivision activities within the municipality;(*) and refers plats to the county planning commission for advice and recommendations.

The planning commission reports on project proposals for public improvements; continues study and makes desirable changes in municipal plan; maintains public education program; and submits annual report to the governing body.

(*) Cities may exercise platting control for a distance of three miles outside city limits.

a statement of normal procedures and general principles to be observed is possible and may be helpful.

City planning properly includes zoning, and the two functions should be carried forward either simultaneously or in close conjunction. Zoning, however, involves a number of special procedures and considerations and is, therefore, discussed separately in a subsequent chapter (Chap. III). The platting-control function of municipal planning commissions is also covered by a separate chapter (Chap. IV).

The Comprehensive Urban Plan.

The first and major responsibility of a municipal planning commission is the preparation and adoption of a comprehensive and long-range development plan showing such things as existing and proposed streets, parks and playgrounds; school and other public building sites; railroads and other transportation facilities, including port and harbor developments and airports; and such other public or semi-public features as may be locally important. This general plan is intended to serve as a guide to the city administration in the execution and timing of public works; to private enterprise affected by the plan; and to the planning board in its subsequent recommendations and in its regulation and guidance of land subdivision activity.

The general urban plan should be based upon much thoroughly assimilated information as to local conditions and trends and upon a careful study of probable future requirements as determined, in part, by the relation of the municipality to the surrounding region. The plan itself should be extended a considerable distance beyond municipal limits to protect the area of probable urban expansion. The Third Class City and Borough Planning Enabling Acts in Pennsylvania authorize the extension of plans for three miles beyond municipal limits.

No comprehensive plan should ever be regarded as finished. A "completed" plan is a dead plan. Changes in controlling conditions and unforeseen developments require continuous change and adjustment. This is one respect in which community planning differs from planning for a house. House plans may be pressed to completion in strict accordance with blueprints, but urban communities are dynamic creations subject to constant change. Plans that are not kept in pace with this changing process are likely soon to become useless.

Required Maps and Basic Data.

A wide range of information and statistical data is necessary to intelligent plan making. A first necessity is the preparation of good maps showing existing conditions and the location, size, and character of public and semi-public properties. These maps in the order of their importance are:

1. *A line map* drawn to scale showing existing streets and other public properties, railroads and other transportation facilities, principal waterways and other controlling topographic features. Copies of this map will be needed for presentation of various kinds of factual data and for showing the general plan proposals. It should be on an easily legible scale but should not be so large as to be difficult to handle or to reproduce at scale. Usually, the scale of this map should not be greater than one inch equals two hundred feet or smaller than one inch equals eight hundred feet. Over-all size of the resulting map is a principal determinant, after legibility is assured. For large cities, it usually is necessary to prepare this map in two or more sections, to be pieced together into one map when occasion requires. The Line Map should have an accuracy consistent with its scale but need not be minutely accurate since it will be used only for general indications and determinations.

2. *An air photograph mosaic* (At the same scale as the above) is one of the most useful tools of city planning and returns its cost many fold in time

saved and in needed information obtainable from it. It has further special value as a record of the existing use of land, essential to zoning. Air photographs can now be obtained at reasonable cost. The State Planning Board of the Department of Commerce will provide full information.

3. *A topographic map.* At least general topographic information is essential, especially so for cities of either very rugged or very level topography. Exact topographic information is necessary for the more advanced stages of planning covering the precise location of streets, and the laying out of various construction projects. The United States Geological Survey maps usually will serve general planning purposes if more detailed topographic information is not available. Precise topographic maps must be made by special survey and should be at a scale of from one inch equals two hundred to one inch equals four hundred feet, or larger.

4. *Miscellaneous maps* of the surrounding county and region.

In addition to maps, the following additional information generally will be needed:

1. The right-of-way and paving widths of all streets; the extent and nature of street improvements; the location, area, and character of development of all parks, playgrounds, and other public properties; the location, age, condition, and capacity of all public schools and other public buildings; the location and channel depths of navigable waterways, and such other similar information as may be locally important.

2. The extent of water, sewer, and other underground public services; and the character and capacity of the water and sewerage plants.

3. Total population, population growth rates for several past decades, and population distribution by density and by racial characteristics.

4. Density and character of land use, to be obtained largely from the air map and field surveys.

5. Financial data, including range of assessed land values, relation of assessed values to true values, gross and net municipal indebtedness, tax rate and tax rate history, and expenditures for capital public improvements over a period of years.

6. Public carrier travel times, schedules and fares within the municipality and between the municipality and regional centers of interest.

7. Number, location, kind, and employment requirements of local and neighboring industries and other major sources of employment; nature and extent of available industrial buildings and sites.

8. Extent and distribution of vacant dwelling units; age and condition of available housing. If large-scale public housing is in prospect, this study should be extended to the making of a detailed housing or real-property inventory for at least the more critical residential areas. Where a municipal housing authority exists, detailed housing surveys will be a proper function of that body.

9. History and social characteristics of the municipality and of its surrounding region.

10. General facts bearing upon local and regional growth and development prospects.

11. All available plans and planning reports prepared by adjoining municipalities and by regional, county, and state planning agencies.

12. Such other facts and materials as may have bearing upon local development.

So far as is possible, the above facts should be shown graphically on maps. Other facts may be tabulated, or assembled and summarized in the form of written statements. For small municipalities, intimately known by planning-board members and planning technicians, it may be unnecessary to go through the formality of actually gathering and setting down all the information listed above. It is important, however, that all of these several items be at least generally known and taken into account in plan making. In making more advanced plans for individual projects such as the widening and extension of streets, much more specific information is of course required.

Making the Plan.

Following completion of base-map making and fact compilation, comes a period of fact analysis and preliminary planning study, a process of appraising the community needs and possibilities and of gradually fitting a plan to their requirements. The first step in plan making should be the making of a future-use-of-land study to determine directions in which the municipality is most likely to grow and the probable future use of its various parts. The future use of land thus determined may be fixed in considerable part by the zoning ordinance and map.

Then comes the making of the comprehensive plan. This plan should show, in approximate location, proposed future public facilities and improvements and needed additions to or changes in semi-public facilities such as railroads and other forms of transportation.

Nature and Scope of Plan.

This plan should be extended far enough into the future to assure sound and comprehensive development. It need not and should not be a commitment as to rate of growth or as to ultimate size of the city but, rather, an indication of and guide as to how growth and development should take place if and when it occurs. By reason of its long-range nature, the plan, as such, should not be made

a dictum fastened down by law, but should be regarded as a sort of guiding framework, constantly subject to change as circumstances may demand. More immediately needed projects shown on the plan may and should be officially adopted, from time to time, by the governing body and placed upon the official map.

Present and future streets and proposed future street widenings and extensions should comprise a primary part of the urban plan. Street recommendations should include a classification of all streets according to traffic function and relative importance. A usual classification is by main thoroughfares, secondary thoroughfares and minor streets. The latter group is made up principally of residential streets serving residential neighborhoods and without "through" traffic functions. By this predetermination of the traffic function of individual streets, it becomes possible to fix street paving widths and strengths more strictly in accordance with actual need, thereby effecting large economies in improvement costs. The custom of many municipalities of paving all streets at uniform or near uniform widths, regardless of actual traffic requirements, is extremely wasteful and, furthermore, is destructive to residential areas by reason of the tendency to make high-speed thoroughfares of all streets.

Wise Street Development Planning.

A further consideration to be urged through the city plan is that all street-paving widths be built up of traffic-lane units of standard width rather than of the usual convenient decimal units of arbitrary 30, 40, or 50 foot specifications or by requiring roadway width in fixed proportion to right-of-way widths. Standard traffic-lane widths for city streets are eight feet for parking; nine feet for average slow-moving traffic; and ten feet for heavy or fast-moving traffic. Exceptions to this rule are minor residential streets, with minimum roadway widths which, in some instances, may be as little as eighteen or twenty feet. Paving width in excess of

multiples of standard traffic lanes is only so much waste. By failure to observe these simple rules cities have wasted upwards of twenty-five percent or more of street-improvement expenditures.

New streets shown on the city plan generally should be limited to proposed main and secondary thoroughfares. The location of minor streets should be left to the land subdivider, under guidance of the planning commission. New and extended main and secondary thoroughfares should comprise the framework for urban expansion and should be so spaced and located as to permit and encourage the development of large, unbroken residential-neighborhood units. Usually a spacing of main thoroughfares at intervals of one mile and of secondary thoroughfares at intervals of one-half mile is adequate. Any such uniformity of pattern, of course, must be adjusted to topographic conditions and seldom will be found strictly applicable in Pennsylvania cities. So far as possible, classification of existing streets should be in accordance with the same principle of concentrating traffic upon widely spaced traffic streets, giving maximum protection to residential neighborhoods against traffic hazards and annoyances. Main thoroughfare spacing naturally must be decreased as traffic ways converge upon business and industrial centers.

Official Building or Set-back Lines.

Street widenings shown on the urban plan are an exception to the general rule that plan provisions should not be officially adopted by the governing body. If street widenings are to be effected economically, usually they must be protected long in advance of execution by officially established building or set-back lines. Such building lines should be placed on the official map by the governing body and given all the protection afforded to mapped streets by law.

Public Properties.

Next important features on the average urban plan are the locations of future parks, playgrounds,

school grounds and other similar public properties and building sites. The free public dedication of such areas by land developers cannot be required by law. But their locations must be indicated and, in many instances, their sites must be acquired well in advance of land development. The larger public areas needed can be shown in approximate location on the plan as can also any extensions of existing holdings. But many of the smaller parks and playgrounds; the school grounds and public building sites, should be built into land-subdivision plans when made. For this and other reasons it may be necessary or desirable to indicate on the plan only a suggested spacing and distribution of these features.

School and neighborhood playgrounds should be spaced at intervals of approximately one mile. In most instances they can be combined to both functional and economic advantage. When the two functions are combined the ground area should be increased accordingly.

Other features, especially those peculiar to a locality, are subject to much less standardization and are less susceptible to general discussion. Indeed it is in the plan that one should naturally look for a local definition of the community's purpose and the type of future growth on which it sets the highest value.

While there are certain general or universal principles applicable to planning as a specialized administrative function, the real tests which specific plans need to meet to be accounted successful are those peculiar to the local community to be served. After all, sound public planning cannot operate in a vacuum of fine ideals; it needs to translate itself into the quantitative terms appropriate for dealing with the physical factors around which human values play. The happy medium lies between good coordination with regional environment and the individuality of the community to

be planned. The final proof of good community planning lies in the better life it promotes.

Long-Range Capital Improvement Program and Budget; Public Housing.

The comprehensive urban plan is an essential aid to long-range programming and budgeting of capital improvements. Such programs and budgets appear to be most practicable when worked out for a comparatively short period—possibly five or six years—and annually extended by one year. The planning commission can and should play a large advisory part in the preparation of the long-range program and budget.

Both the comprehensive plan and the planning commission have an important function also in determining the location and character of large-scale public housing projects. A principal cause of premature obsolescence of residential districts and of the high cost of decent housing, is bad and uneconomical street planning. Misplaced housing projects and housing projects built around old outmoded street plans fail as basically sound improvements and are prone to excessively rapid deterioration. The urban plan and its supporting information should be major guiding forces in both the location and design of new housing. On the other hand, neither the city plan nor any of its supporting legislation should be such as unnecessarily to restrict the form of new housing. We are in the process of developing new types of residential neighborhoods, and old standards and traditional patterns in street and block arrangement often are neither applicable nor desirable in new developments.

Carrying out the Plan.

Beyond plan making are plan protection and plan execution. The function of the planning commission, in protecting and carrying out the urban plan, varies somewhat according to the class of municipality and according to the specific enabling legislation under which the commission is operating. But the planning commission's powers in third-class cities, boroughs, and first-class town-

ships in Pennsylvania are never more than advisory except in the matter of platting control as discussed in Chapter IV (page 37). In third-class cities and in boroughs, the governing body is required to submit all development proposals to the planning board for report and recommendation. This provides assurance that the governing body shall not proceed without the advice of the planning commission; but an unfavorable report from the planning commission places no restriction upon the final decision of the governing body.

A planning commission's chief tools for realizing its plan, are informed judgment and public opinion. This condition requires that an effective planning commission be comprised of men of prestige and of unusually sound judgment, and that the commission be non-political in both composition and action. It requires, further, that a good share of the time and effort of the planning commission should be devoted to public education as to the nature and objectives of plans and of planning. This education may take the form of newspaper releases, printed reports, public talks, and more or less formal introduction of planning into school curricula.

Proper Function of Public Planning is not Project Promotion.

A common pitfall for planning commissions is the misconception that their primary function is to promote public improvements. It may be proper and advisable, in specific instances, for a planning board to press for immediate action in making an improvement or in acquiring property for a specific use, in order to correct some bad condition or to meet some deficiency. But the principal function of the planning commission is that of guidance in public improvement, if and when such normally occur, and not that of the promotion of projects. Success of a city plan is to be measured more by the extent of its observance in current development than by the speed with which plan recommendations are carried out. Too much emphasis upon the number of costly improvements made, as evidence

of successful community planning, has caused too many planning commissions to be looked upon as expensive luxuries.

To this statement, one exception must be noted. Under the Urban Redevelopment Law of 1945, P.L. 991, it is the duty of a county or city planning commission, wherever an urban redevelopment authority has been appointed, to inform the authority as to areas needing redevelopment and to supply the authority with an appropriate plan for such action.

Areas needing redevelopment are defined under the law as those which have become blighted because of the unsafe, unsanitary, inadequate, or overcrowded conditions of dwellings, or because of inadequate planning of the area or excessive land coverage by the buildings, or the lack of proper light, air, and open space, or because of the defective design and arrangement of the buildings, faulty street or lot layout, or economically or socially undesirable land uses.

The plans, which are required to be submitted to the authority by the local planning commission, may include the rehabilitation or rebuilding of such an area for residential, recreational, commercial, industrial, or other purposes, including the provision of streets, parks, recreation areas, and other open spaces.

Any urban planning commission with a full sense of its responsibilities to the people of the community should also make recommendations to the proper State departments as to needed highway, park, or institutional developments which fall within the local area or its surrounding territory.

The commission should also make a study of the effect of all proposed State public works on their community's welfare, and suggest such changes as may be locally necessary or desirable.

Two prerequisites to effective planning commission operation are adequate working funds and

competent technical assistance and guidance. Funds need not be great and technical staffs or technical assistance need not be elaborate. But unless a planning commission has these things it is virtually helpless, accomplishes little, and quickly becomes discouraged. Unless the governing body can see its way clear to finance its planning commission in proportion to the duties assigned to that agency it may be better to defer commission appointment.

In connection with the cost of preparing a community plan, attention is called to the provisions of the Regional Planning and Zoning Enabling Act which are more fully discussed in Chapter VI of this publication. Under Pennsylvania law it is possible for two or more adjoining municipalities or townships to cooperate in both planning and zoning activities, to share the cost of retaining planning engineers and consultants or employing professional planning services and to join in paying any needed expense for developing plans or zoning ordinances covering their area. Under agreements of this nature two or more communities not able to finance individually the development of adequate plans or zoning ordinances may be able by agreement to carry out a program for their individual and mutual benefit. The revised text of the State's Regional Planning and Zoning Enabling Act will be found in the Appendix to this volume.

Chapter III

URBAN ZONING

All counties, municipalities, and townships in Pennsylvania now have authority to zone. Zoning problems and basic considerations will vary according to whether the area to be zoned is rural, suburban, or urban. But just as general principles and procedures are the same for all zoning; so, also, are the limitations as to what can be done through zoning.

Consideration of this circumstance points to the following as desirable procedure specifications:

Cardinal Points and Procedures in Most Effective and Most Satisfactory Zoning.

1. *Strict adherence to legal procedures set forth in the particular zoning enabling act under which the work is being done.* This includes conformity to prescribed procedures in the creation of the zoning commission, in preparing the zoning ordinance and map, in holding public hearings and in giving proper public notice thereof, in appointing the board of adjustment, in actions and procedures of the board of adjustment, and in amending the ordinance or map subsequent to initial adoption. Failure to observe any such prescribed procedures may result in having the ordinance declared illegal and ineffective.

2. *Zoning should be considered as a part of comprehensive planning rather than as a separate operation.* As such, it should be done either simultaneously with comprehensive planning or should follow comprehensive planning. Good zoning must anticipate future urban expansion and development. The character and direction of urban expansion is determined in considerable part by comprehensive planning. Knowledge of comprehensive plan provisions assures more intelligent zoning. Zoning helps to protect the comprehensive plan. Further, in case of legal attack upon the zoning ordinance, courts are inclined to give the bene-

PROGRAM FOR ESTABLISHING ZONING IN CITIES; BOROUGHS; AND TOWNSHIPS OF THE FIRST CLASS

The municipal governing body appoints a zoning commission, or assigns the zoning function to the planning commission.

The zoning commission, after making preliminary studies and surveys, prepares a tentative zoning ordinance and map.

The zoning commission holds public hearings on the ordinance, prepares the final report and submits it to the governing body.

The governing body holds the required public hearings, refers any revisions to the zoning commission, and subsequently enacts the zoning plan and ordinance.

Certified copies of all existing and all new zoning ordinances and amendments must be filed with the county Recorder of Deeds by each political subdivision.

The governing body, upon enactment of the ordinance, appoints a board of adjustment to consider appeals for exceptions and variances, and also appoints a zoning officer to administer the zoning ordinance.

Note: Boroughs may advertise zoning ordinance by reference.

fit of doubt to the ordinance that has the support of such thorough study as goes into comprehensive plan making.

3. *It follows that planning and zoning should be done by one commission.* This will assure necessary coordination between the comprehensive plan and the zoning map. It also makes for economy and efficiency because good zoning requires much the same fact-gathering and preliminary studies as is required for planning, and, if two commissions are working in such closely related fields, much overlapping of work and much conflict will be unavoidable. The third-class city, borough, and first-class township zoning enabling acts, all provide that planning commissions may be authorized to serve also as zoning commissions. If there is question of choice between appointment of a planning commission or a zoning commission, decision should be in favor of the planning commission with zoning powers because the planning commission has much the broader field of operation and much the greater opportunity for valuable public service.

4. *Zoning must be reasonable.* It should not be used to impose arbitrary restrictions which have no accepted or demonstrable bearing upon the general public welfare or the best use of land. If very special architectural effects are desired, it is probable that they should be achieved through private deed restrictions rather than through zoning. Existing conditions should be taken carefully into account. This does not mean, however,—by way of illustration,—that, because scattered business properties exist in an area which logically should be residential the area must be left open for business. If existing business areas are not sufficiently numerous definitely to determine the character of a neighborhood, the area may be zoned as residential, with business properties allowed to remain as "nonconforming" uses with restrictions as to permissible expansion.

5. *The ordinance should be reasonably elastic.* It should not be so drawn as to discourage or prevent new and improved kinds of housing development. Standard zoning is designed to regulate and protect small, single-lot development. This is true particularly of yard and building-line regulations. Every ordinance should permit departure from such standard regulations in the case of large-scale housing operations, providing equivalent open space is otherwise set aside and providing other safeguards are clearly specified in the ordinance.

6. *Precaution should be exercised against placing too much land in business and industrial districts.* Over-zoning for business and industry is a common failing. To their sorrow, many municipalities have zoned more area for business than can be absorbed by hundreds of years of business expansion. Business districts should be large enough to allow for reasonable expansion and large enough to prevent bestowal of monopoly upon existing business properties. But over-zoning for business has the effect of depriving large residential areas of zoning protection, with the result that further investment in residential construction and improvement in those areas is stopped. Not needed for business purposes and shut off from residential improvement, these over-extended areas gradually sink into slum and blighted conditions. The best time to prevent over-zoning for business and industry is at the start. After property exchanges have taken place and after taxes have been levied upon business-district properties, a shift of land from business to residential districts becomes difficult. It is always much easier to change an area from higher to lower restrictions than it is to raise restrictions. When in doubt, it is always better to impose the higher restriction.

7. *The same principles hold true for over-extensions of apartment house districts.* In opening an area for apartment house development, the

entire area should be pictured as occupied by apartment houses, for the right of one owner in a district is the right of all. And in so doing, consideration should be given to the capacity of existing streets, sewers, and water mains to carry the extra load to be imposed by the calculated increase in population density.

8. *In cities already greatly over-zoned for business, industry, and apartment house development, immediate attention should be given to rezoning directed toward at least some degree of correction of these mistakes.* It probably will be impossible to do as good a job of redistricting these areas as might have been done at the start, but, usually, highly worthwhile improvements can be made. The longer the over-zoned situation continues, the harder it will be to correct.

9. *Zoning ordinances should be as simple in language, and the kinds of districts should be as few as is consistent with achieving the desired results.* The necessary number of district classifications will vary with individual communities according to the range of existing development and of existing property uses. For the average city the following number and kinds of districts usually will be found sufficient: one to three residential districts, including single family, small multiple family, and apartment house; one or two business districts, possibly a neighborhood business district and a central business district; a commercial district open to warehouses and heavy commerce, and one or two industrial districts. To these might possibly be added a light industrial district; a heavy industrial district; an airport district, and, in rare instances, an unrestricted district. There is the further possibility of a "flood plain" district, restricting areas subject to frequent flooding to uses susceptible of minimum flood damage. This, however, is a new departure in zoning.

Indeterminate areas, such as rural districts, should be placed in the highest district rather than in an "unrestricted district." Later changes can be made for these open areas as developments may require. Usually all uses permitted in a higher district are permitted in all lower districts. An occasional exception is the exclusion of residences from industrial districts. This, however, requires a somewhat finer determination of the extent of industrial districts than is the usual practice. When residential development is allowed in business, commercial and industrial districts, appropriate residential regulations should be made to apply to these districts, also, to assure healthful and safe living conditions.

10. *There are a number of uses, such as for hotels, clubs, and various institutions which, under certain conditions, are not objectionable in any district.* These may be allowed in the higher-restriction districts, subject to special permit to be issued by the board of adjustment, and under conditions specified in the ordinance.

Necessity for Good Zoning Administration, Adjustment Board and Zoning Officer.

Good zoning may be destroyed or made ineffective by bad administration. Most critical in administration are the policies and actions of the Board of Adjustment. Some such agency as a board of adjustment is essential to zoning administration in order to avoid imposition of unnecessary hardships upon individual property owners, as it is impossible to foresee and provide for all contingencies in the framing of any general ordinance or law. The board of adjustment is created to take care of specific cases where relief can be given without violating the intent of the zoning ordinance. However, the Board of Adjustment frequently abuses or misinterprets its powers and duties. The powers of the Board of Adjustment are specified in the zoning enabling act. They should be further stated and specified in the zoning ordinance. The Board should adhere strictly to its powers as thus defined.

Exceptions to the literal interpretation of the zoning ordinance should be granted only in case of demonstrated unusual hardship as applied to a specific property. If; for instance, an appeal is merely for the allowance of a use in a district where that use is prohibited, favorable action by the Board of Adjustment usually should be a recommendation to the governing body for a change of district rather than the granting of a permit contrary to law. Granting of frequent use exceptions by the Board of Adjustment quickly breaks down the best of zoning ordinances. The zoning Board of Adjustment is charged with administering and not with changing the law.

The direct administrative agent in zoning is the zoning officer—the official who issues zoning permits and who is charged with inspecting developments and construction for conformance with the zoning ordinance. The zoning officer is allowed no discretion in issuing permits. If a projected use or building conforms with ordinance requirements, he must issue a permit. If it does not conform, the officer must refuse a permit and advise the applicant that an appeal from his decision may be taken to the Board of Adjustment.

Amendment.

Frequent and ill-considered amendments to the zoning map are as disastrous to effective zoning as the over-stepping of its powers by the Board of Adjustment. When map changes—other than extensions of existing district boundaries—are made, they should be for reasonably large areas rather than for individual lots. They should be for the entire areas subject to whatever conditions may be the reasons for such changes. This, of course, holds true also for the establishment of districts and district boundaries in the original ordinance. Property lines should not be determinants in the fixing of district boundary lines, either in making the original zoning map or in amending the zoning map.

Zoning ordinances more than five or ten years old are likely to be out of date and probably should be completely or extensively rewritten. Zoning in this country is only about thirty years old. Many of the older ordinances were more or less experimental and can be greatly improved in the light of more recent experience in ordinance drafting, in administration, and in court actions.*

General Considerations.

Zoning is a specialized technical process, more planning than law. Unskilled zoning is likely, in the long run, to do more harm than good; may lead to avoidable expensive litigation; may be ineffective; may impose unnecessary or unwise restrictions; or may fail to give protection where needed. Municipalities will do well to employ qualified and experienced assistance in their zoning and rezoning operations.

Municipalities are especially cautioned against using ready-made ordinances; that is, against verbatim copying of ordinances or parts of ordinances of other places. Unlike many municipal enactments, zoning ordinances should be carefully adapted to peculiar local conditions and requirements. A zoning ordinance admirably adapted to the needs of one municipality may be entirely unsuited to another. Ordinances of other municipalities may prove helpful guides, but clauses from them should be applied locally only after very careful consideration.

In framing a zoning ordinance, the text of the ordinance should not be emphasized to the point of forgetting that the zoning map, which determines where and how the various regulations are to apply, is equally if not indeed more important.

* Legal procedures to be followed in either new zoning or rezoning are outlined in Chapter VIII. They are defined in greater detail in the several enabling acts, copies of which are to be found in the Appendices.

Chapter IV

LAND-SUBDIVISION REGULATION AND CONTROL

Under Act No. 212 of 1947, an amendment to the General County Law, a county planning commission, if one has been constituted, has jurisdiction and control of the subdivision of land located within the county limits, except that within any city or borough. Plans, plots, or re-plots of land used in building lots, and the streets or highways or other portions of such plots intended to be dedicated for public use, must be submitted to the county planning commission, and approved by it, before such plot shall be recorded.

This act contains specific penalties against any owner or agent who sells or transfers land by reference to the plan of a subdivision before that plan has been approved by a county planning commission, and a specific statement that the description of such lots by metes and bounds does not exempt the seller from such penalties.

Under Section 507.1, the County Planning Enabling Act contains the further provision that all plat maps for land subdivisions within boroughs and cities shall be submitted to the county planning commission for report thereon, prior to final adoption. This submission shall be by whatever local agency has the platting-control authority—the borough or city planning commission if such exists; otherwise, the borough or city governing body. Action of the county planning commission in this latter regard is entirely advisory. An unfavorable report has no binding effect upon final action of the local platting-control authority.

Third-class city planning commissions have platting-control authority for all land subdivision within city territory and within three miles of city limits. Borough planning commissions and First

Class Township commissioners have platting-control jurisdiction over land subdivision within their own boundaries.

Legislated Powers.

Under the platting-control powers of the several governmental agencies, land subdividers are denied the privilege of recording or filing plat maps which do not bear the endorsement of approval by the proper platting-control authority. Approval of a plat map by a county or municipal planning commission has the effect of official acceptance of streets and other public areas shown thereon, but does not obligate the governing body, either county or municipal, to assume responsibility for improving or maintaining such streets or other public properties. Assumption of official responsibility for such maintenance and improvements must be by action of the governing body.

Planning Commission the Proper Platting-Control Agency.

Platting-control power is the planning commission's most effective tool for lending force to county or city plans. It may be a means of substantial local improvement in land-subdivision standards. In the absence of a planning commission, platting-control authority rests with the municipal governing body. But there are many reasons why this responsibility is better carried by a planning commission. For third-class cities, the platting-control jurisdiction of city council is limited to the confines of the city, while a planning commission's area of jurisdiction is extended to all territory within three miles of the city limits. Frequently it is in the outlying territory, where land subdivision is most active, that the greatest need for guidance exists. A further reason for platting-control by a planning commission rather than by the municipal governing body is that the former agency is likely to be less political and less subject to political pressures. Finally, platting control should be guided largely by the long-range plan. The community plan is a product and responsibility of the planning commission. It is logical, therefore, that both planning and platting control

rest with one and the same governmental agency. In the case of county government, the county commissioners have no platting-control powers whatever, except as they may be exercised through a county planning commission.

The Advantages of Good Subdivision Design.

Land subdivision regulation, as operative by county and municipal planning commissions, serves several important public purposes. It assures conformity to long-range development plans, especially in the matter of location, width, and continuity of projected main thoroughfares. It is a means for coordination of plat maps of adjoining land areas. By its use, planning commissions may do much to bring about improved livability of land subdivisions and may do much toward effecting economies in improvement and maintenance costs.

The importance of establishing continuous main thoroughfares and of tieing adjoining subdivisions together to avoid hodge-podge land development is obvious. Not always so clearly understood are the possibilities of improving living environment and of reducing street-improvement and public-servicing costs through skillful land-subdivision design.

Planning commissions cannot always *require* good subdivision design but they can accomplish much in this direction by moral suasion and by gradual education of land subdividers and of their agents.

Prerequisites to Platting-Control Administration.

The two most important prerequisites for effective and intelligent land-subdivision regulation and control are: (1) a comprehensive and long-range development plan and (2) a set of platting rules and regulations, prescribing procedures to be followed by land subdividers and by the planning commission in the process of plat map preparation and approval, and setting forth standards and other conditions to be required by the planning commission for plat map approval.

The nature and operation of the comprehensive plan are discussed in earlier chapters. Platting

rules and regulations have not previously been mentioned except in passing. They are to be prepared and adopted by the planning commission and are not subject to enactment into law by the governing body, thereby assuring necessary elasticity in their application. In many instances, as explained below, some supplementary legislative action upon the part of the governing body may be needed to support and to enforce special planning commission requirements.

Platting Rules and Regulations.

Platting rules and regulations should include:

1. *A statement of procedures to be followed by the land subdivider in submitting a plat map for approval and procedures to be followed by the planning commission in considering plat maps submitted.* Among other things, these procedures should provide for two steps in plat map submissions: (1) submission of a preliminary plat map, subject to adjustment and conditional approval, and (2) submission of a final or record plat map which shall show any changes in such preliminary plat map as may have been specified by the planning commission.

2. *A list of engineering data and other information required to be shown on both the preliminary and final plat maps.* This should be sufficient to assure that all important topographic and other information has been available to the subdivider in making his plan; sufficient to assure that the location of all development features is feasible and that the location and dimensions of all streets, lots, and other areas shown on the plat-map can be readily determined in the office and on the ground, and sufficient to show the physical relationship of the land being subdivided to neighboring properties and to existing streets in the near vicinity.

3. *A list of approximate standards to be required.* This may take the form of a statement as to minimum and maximum allowable block di-

mensions, minimum and maximum allowable street grades, et cetera.

4. *A list of special requirements* such as: minimum provisions for drainage, number and location of permanent monuments, and extent of improvements to be installed by the land subdivider.

Requirements of items No. 3 and No. 4 above, should be such as to allow considerable discretion and elasticity, to satisfy unusual conditions and unusual developments. Even approximate standards should be determined and applied with caution. Minimum standards are likely to be looked upon as maximum requirements. All applied standards have a tendency to discourage or prevent new and improved forms of development. Some well-intended standards, commonly adopted and applied by planning commissions and municipal governing bodies, actually defeat the objectives of good modern planning and prevent the kind of improvement and economies illustrated in Chapter V pages 46-51. Especially undesirable are such arbitrary rulings as: "all streets shall be continuous;" "there shall be no dead-end streets;" "no lot shall be less than 150 feet in depth;" "no street shall have a paved width of less than 30 feet," and "every street shall have two sidewalks." Only main thoroughfares need be continuous. Residential streets are better broken and made indirect in order to discourage through and fast traffic in residential neighborhoods. Dead-end streets, if ample turn-arounds are provided at their ends, often afford the best of residential sites. Other such arbitrary requirements may impose improvement and maintenance costs far beyond any need.

While planning commissions, presumably, have the authority to regulate lot sizes, it is often better to apply lot-size control through zoning than through land-subdivision regulation. Zoning determines usable lot sizes indirectly by the side,

front, and rear yard requirements. For areas where zoning is not in force or where zoning requirements are not adequate, the planning commission should require lot sizes consistent with the intended and probable use of individual land subdivisions. Special effort should be made to discourage the all too common subdivision practice of dividing land into very small lots, 20 or 25 foot frontage, with the idea of selling two or three lots for one. Further, it may be found desirable in connection with land subdivisions inaccessible to sewers and public water supply to require lot sizes large enough to permit the safe installation of both sanitation devices and wells on individual lots.

An important requirement for all land subdivisions is that of established building lines, to be shown on the record plat map in location as indicated by or as approved by the commission.

The subdivider should be required, as a condition for plat map approval, to install at least sufficient improvements to give all-year-round accessibility to lots offered for sale.

Further Regulatory and Guiding Procedures

It is an increasing practice among municipalities to require extensive subdivision improvements, including permanent street paving and sidewalks and even sewer and water installation, before accepting streets or giving service to subdivided areas. Such requirements have the advantage of discouraging premature and purely speculative land subdivisions, and of acquainting the lot buyer at the start with the actual cost of his lot. Requirement of the more extensive improvements, however, usually is by act of the governing body rather than by the planning commission.

The most effective weapon in requiring necessary subdivision improvements is the power of the governing body to refuse public services to nonconforming areas. Planning commission requirements of this sort should, therefore, have the support of legislative enactments by the governing

body. Other powers of enforcement under the police power also rest with the governing body and not with the planning commission; all necessary "penalty" provisions should be by ordinance of council.

A related consideration, more directly the concern of municipal governing bodies than of planning commissions, however, is the question of extent to which municipalities should cooperate with land subdividers in the advance-financing of land-subdivision improvements, with the expectation of reimbursement by special-assessment levies upon building lots. Many municipalities throughout the country have come to financial grief through such practice Especially is this true of areas of excessive land-subdivision activities where the number of lots so far exceeds the demand that many lots are no longer worth the improvement costs assessed against them, and assessment arrears have necessitated large additions to annual municipal budgets. The better practice,—as indicated above,—is to leave financial responsibility for improvements entirely with the subdivider. This insures greater care and caution upon his part and tends to prevent premature land subdivision. It keeps municipalities out of "special-district" debt and safeguards the taxpaying public against carrying the costs of improvements from which it receives no benefit.

Premature Land Subdivision; Consequence and Control.

Premature land subdivision has become a serious problem in many localities. Even where assessment arrears for publicly financed subdivision improvements are not involved, there is the almost equally severe financial difficulty coming from high incidence of tax delinquency for vacant lots. Studies made by the New York State Planning Council indicate that by far the greatest number of tax delinquencies are for vacant properties and the number of such delinquencies increases with the degree of prematurity of land developments. It is to the financial interest of municipali-

ties and to the interest of the lot-buying public that the quantity of land subdivision be kept in some reasonable relation to the probable demand. It is not within the province of the planning commission, usually, to deny a property owner the right to subdivide his land into building lots. The planning commission and the municipal governing body can, however, employ such "brakes" as are suggested herein. And the planning commission can refuse to approve land subdivisions which are incapable of proper development or safe occupation because of flood hazard, bad drainage, impracticability of servicing, or peculiar topographic conditions.

The principal compulsion behind requirement of planning-commission approval of plat maps is the provision that the county recorder may not accept plat maps for record without this approval. In order to insure smooth operation of this legal provision, the newly created planning commission should make it a first order of business to transmit to the county recorder (or to the corresponding county official) official notification of the fact that the planning commission is in operation and that all subsequent plat maps shall bear the endorsed approval of the commission, as provided by law.

As previously suggested, the planning commission can accomplish much by moral suasion and education that cannot be legally required. Friendly relations and mutual respect between land subdividers and the planning commission are important to best results. From the start, platting-control authorities should recognize that not all violations of the public interest by land subdividers are willful. Sometimes they are due to ignorance of projected plans and of public desires. Sometimes the subdivider or his engineers simply do not know how to do a better job. A principal function of the planning commission is to acquaint the subdivider with existing development plans and, gradually, to educate him in better subdivision

practice. This is not as difficult as it may sound, for, usually, the better subdivision plan will provide just as many (if not more) salable lots as will the bad plan. And no one will be quicker to see this, under guidance of the planning commission, than the subdivider himself.

Many of the elements in successful control and guidance of land subdivisions activity listed above, require special technical proficiency upon the part of the planning commission or its staff, or both. Without this proficiency, regulations are likely to be perfunctory and may represent merely the substitution of perhaps less qualified judgment for the judgment of the subdivider and his engineers. The planning commission is an exceedingly important instrumentality for improvement in urban-development practices, through the regulation of land platting. But the planning commission must be armed with the proper knowledge and technical skills if it is to do a good job.

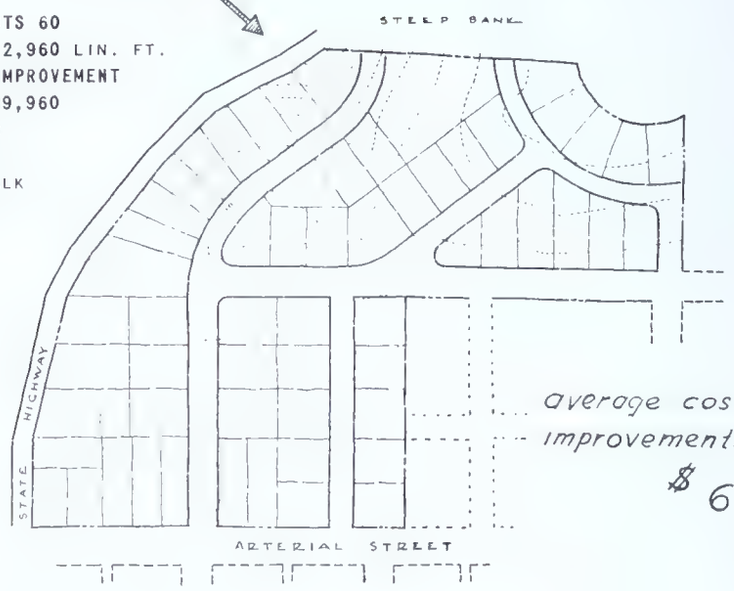
RECOMMENDED REVISIONS OF A

12 ACRE SUBDIVISION

FOR LOW COST HOUSING - PENNA 1947

A - ORIGINAL PLAN

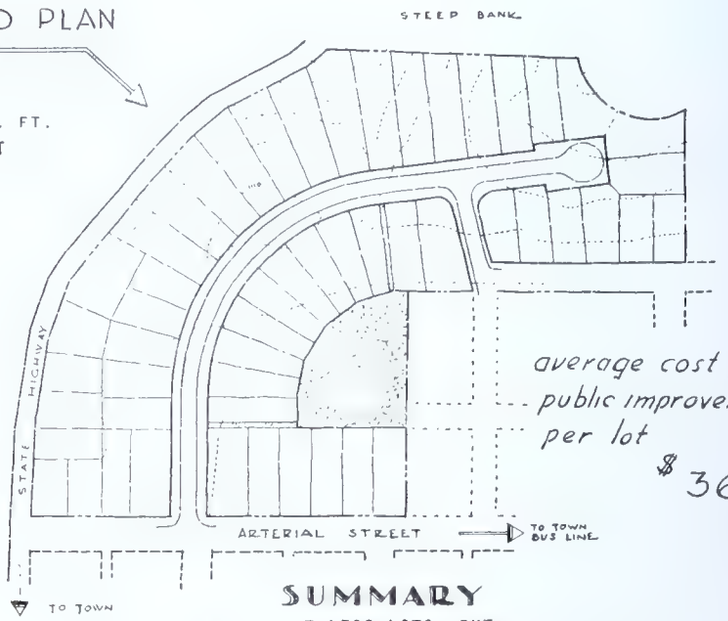
TOTAL LOTS 60
STREETS 2,960 LIN. FT.
PUBLIC IMPROVEMENT
COSTS $39,960
- PAVING
- CURB
- SIDEWALK
- SEWER



average cost for public improvements per lot
$ 666 00

B - REVISED PLAN

TOTAL LOTS 53
STREETS 1,420 LIN. FT.
PUBLIC IMPROVEMENT
COSTS $19,170
- PAVING
- CURB
- SIDEWALK
- SEWER



average cost for public improvements per lot
$ 362 00

SCALE
0 500'

PLAYGROUND OR PUBLIC WALK-WAYS

CONTOUR INTERVAL - 10 FT.

SUMMARY

7 LESS LOTS, BUT
- 1540 FT. (52%) LESS STREET TO CONSTRUCT AND MAINTAIN
- $20,790 SAVING IN PUBLIC IMPROVEMENT
- $304 AVERAGE SAVING PER LOT
- ONE ACRE RESERVED FOR PLAY SPACE
- SIMPLIFIED SCHEME FOR ROADS, SEWER, STORM WATER DRAINAGE AND GRADING

Chapter V

EFFICIENCY IN SUBDIVISION LAYOUTS*

The subdivision layouts illustrated on the following pages are examples of typical plans as submitted to municipal authorities for their approval. Revised versions as finally adopted, show what advantages can accrue, both to the developers and to the municipalities, through the proper adaptation of the subdivision layout to the contours of the land and to the requirements for public facilities which must be erected at the cost of the community.

These revisions result in reduced street and public utility extensions, greater convenience to the future residents of the area, reduced traffic hazards, and lower site development costs.

Planning commissions cannot always *require* good subdivision design, but they can exercise great influence by intelligent and useful advice to land subdividers and their agents.

REVISION OF A TWELVE-ACRE SUBDIVISION

The original plan submitted shows a very complicated street pattern. The revised plan, although lessening the total number of lots from 60 to 53, has a very simple and direct access street which fits the grade in such a way that sewers and surface drainage will be easily handled.

Through sacrificing eight lots in the revised scheme the cost of public improvements per lot has been reduced from $666 to $362, or a net saving of nearly $21,000 on the development. In addition, a small play area has been provided for the residents.

Inasmuch as this particular area was proposed for low-cost housing, it was only through the revision of the plan and the decrease in public improvement costs per lot that it was possible for the developer to proceed.

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* *By Carl W. Wild*

RECOMMENDED REVISIONS OF A

40 ACRE SUBDIVISION

A-ORIGINAL PLAN

TOTAL LOTS 135
STREETS 7,920 LIN. FT.
PUBLIC IMPROVEMENTS COSTS

PAVING	@ $2.50 SQ.YD.	$61,539
CURB	@ 1.25 LIN.FT.	19,800
SIDEWALK	@ 1.25 LIN.FT.	19,800
SEWER	@ 2.50 LIN.FT.	19,800
TOTAL		**$120,939**

AVERAGE COST PER LOT $895



B-REVISED PLAN

TOTAL LOTS 131
STREETS 5,975 LIN. FT.
PUBLIC IMPROVEMENTS COSTS

PAVING	@ $2.50 SQ.YD.	$43,825
CURB	@ 1.25 LIN.FT.	14,936
SIDEWALK	@ 1.25 LIN.FT.	14,936
SEWER	@ 2.50 LIN.FT.	14,936
TOTAL		**$88,633**

AVERAGE COST PER LOT $676



SUMMARY

4 LESS LOTS - BUT

- 1,945 FT. (24%) LESS STREET TO CONSTRUCT AND MAINTAIN
- $32,306 SAVING IN PUBLIC IMPROVEMENTS
- $219 AVERAGE SAVING PER LOT
- REDUCE TRAFFIC HAZARDS-NO FULL INTERSECTIONS
- MAXIMUM STREET GRADE 9% INSTEAD OF 14%
- MORE ATTRACTIVE AND LESS " REGIMENTED " NEIGHBORHOOD
- GREATER FEELING OF OPENNESS
- MORE SALABLE

SCALE

0 500

EXISTING LARGE TREES

CONTOUR INTERVAL - 10 FT.

In the plans shown, a definite saving of over $32,000 in public improvements has been achieved, which is of importance, not only to the developer but also to the municipality in terms of less street area to maintain in the future.

In this particular revision consideration was given to the desirability and greater sales value of the lots at the top of the hill-slope shown by the contours. By bringing together the smaller lots on the lower loop of the revised plan so that it would not interfere with the views from the higher and more desirable lots, it was possible to achieve a greater interest and charm in both types of residential development.

Straight streets, superimposed upon this particular hillside location, would be extremely undesirable.

It will be noted, in the original plan, that there are three street intersections at the bottom of the hill, each of which creates a definite traffic hazard. In the revised plan, most of the main traffic is directed to the major highway at the left of the property, thus avoiding, so far as possible, any use of residential streets for fast through-traffic.

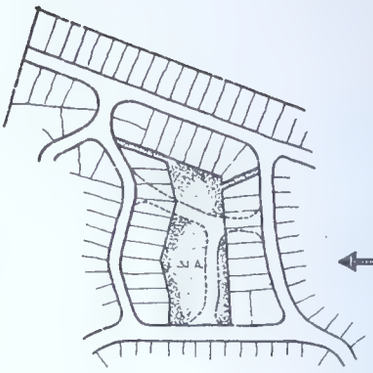
The apparent double frontage found on the properties to the left in both plans is created by a steep bank along the main highway. The revised plan applies the basic principle of reducing frontage on major arterial streets, thereby protecting the free flow of through-traffic.

This revision caused a loss of four lots, but resulted in a saving of 24 percent in the street construction, and a reduction of 5 percent in the maximum street grade.

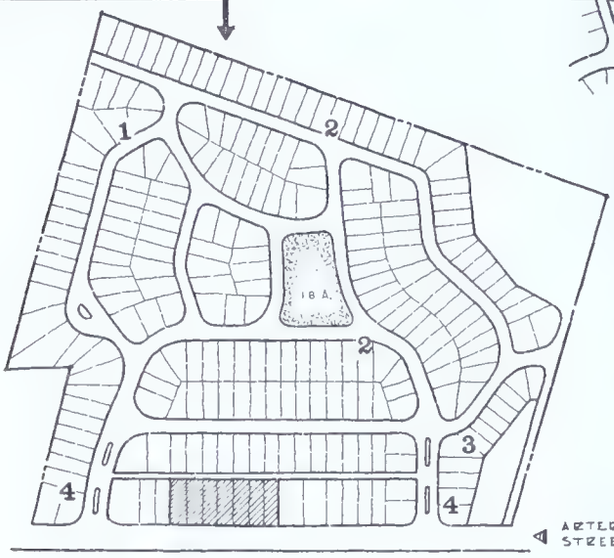
RECOMMENDED REVISIONS OF A

60 ACRE SUBDIVISION

PENNA. 1947



A - ORIGINAL PLAN



B - MINIMUM REVISION

ELIMINATE 925 FT. OF STREET
INCREASE PARK 1.8 A. TO 3.1 A.
REDUCE TRAFFIC HAZARDS
AROUND PARK
LOSE ONE LOT, BUT

SAVE $15,000 IN PUBLIC IMPROVEMENTS

C FINAL REVISION

STREETS

1 SIMPLIFIED - PERMITTING A SELF-CONTAINED LOOP FOR INITIAL DEVELOPMENT AND SIMPLER LOT LAY-OUT

2 IMPROVED INTERSECTIONS

3 IMPROVED CURVE

4 ELIMINATE BOULEVARD (COSTLY MAINTENANCE)

PARKS

INCREASED FROM 1.8A. TO 3.1A.

PEDESTRIAN ACCESS TO SHOPPING CENTER THRU PARK

FUTURE GRADE SCHOOL LOCATION ABUTTING PARK

SHOPPING CENTER

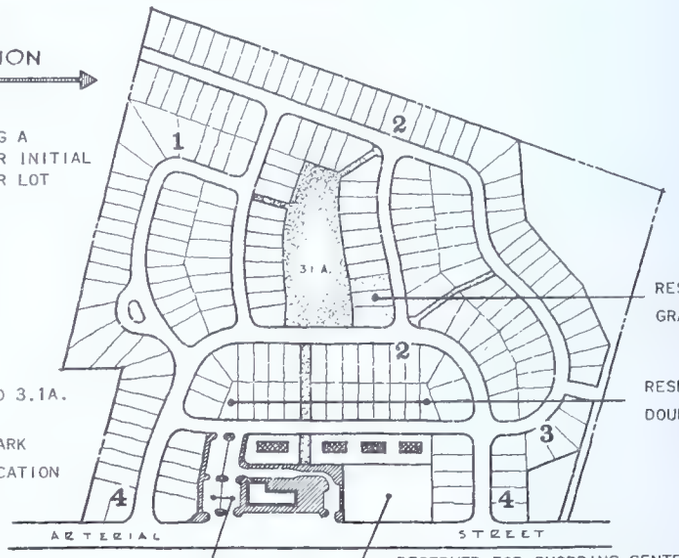
ADEQUATE SET BACK FROM ARTERIAL STREET

ADEQUATE PARKING AND UNLOADING

PROTECTION OF ABUTTING RESIDENTIAL PROPERTIES FROM ENCROACHMENT

PROVISION FOR APARTMENTS USED AS BUFFER BETWEEN COMMERCIAL AND RESIDENTIAL AREAS

EASY AND SAFE ACCESS FROM INTERIOR OF DEVELOPMENT



SCALE

0' 300'

SHOPPING CENTER

APARTMENTS

PARK OR PEDESTRIAN WALK-WAY

REVISION OF A SIXTY-ACRE SUBDIVISION

The original plan, although generally laid out to relieve the monotony of a gridiron pattern, had a number of points which were improved through further study.

The plan as first drawn shows a park of 1.8 acres, surrounded by streets. This is not only too small to be of any practical benefit, but is dangerous and wastes street frontage which might better be devoted to property service.

As will be noted under "B", the entire elimination of the interior lots and redesign as shown, without changing the outer streets, would have increased the park area to 3.1 acres, and would have eliminated nearly 1,000 feet of street with its accompanying ultilities, and reduced the traffic hazard around the park in the original plan. One lot was lost in this layout, but $15,000 in public improvement was saved.

Studying this same layout further, with respect to a potential shopping center which will obviously be needed, it was decided that such a center must be designed with facilities for parking, and that it would be a great mistake to provide a future business area merely by designating certain lots along the main street, as was shown on the original plan.

In the development of this objective, it was found possible to provide a pedestrian walkway to the shopping center from the park area and the interior of the entire development. A buffer-strip between the business area and the single family development has been reserved for double houses and apartments.

It is of interest to note that the plan for this shopping center, with its provision for parking, has within a year and a half led to requests for plots to build a super-market, a theater, a bus station, and a restaurant.

PROGRAM FOR ESTABLISHING REGIONAL PLANNING AND ZONING IN PENNSYLVANIA

Two or more adjoining civil subdivisions jointly agree to engage in a planning and zoning program on a regional basis.

The cooperating administrative bodies join to create a regional planning commission; determine the number and qualifications of its members; agree upon proportionate shares of expenses; and respectively appropriate such funds.

The regional planning commission employs such staff and consultants as it may require, and prepares surveys and studies necessary for the development of general plans and zoning ordinances for the region.

After such plans and zoning ordinances have been developed, any of the cooperating governmental units may adopt them for administration on a local basis.*

Any of the cooperating administrative bodies may delegate any or all of the powers and duties of their local planning agencies to the regional commission.

* Note: Zoning ordinances, although prepared on a regional scale, must be administered locally.

Chapter VI

REGIONAL PLANNING PROCEDURES

Two or more adjoining municipalities may now unite through joint agreement in the performance of their respective governmental powers, duties and functions. This covers a wide range of activities and may include such items as water supply, recreational programs, sewage disposal, public health activities, and the functions of planning and zoning. The legislation for this regional approach is contained in two acts of the General Assembly —the County Planning Law of 1937 and Act No. 159 of 1943, as twice amended in 1945. It authorizes such municipalities to contract for professional services as well as property and materials, and to allocate costs and expenses for carrying out their cooperative duties.

Purpose and Advantage of Joint or Regional Planning

In the field of planning and zoning, the purpose of the regional planning provision is to permit the creation of planning boards with a jurisdiction coterminous with actual planning problems. Only in rare instances is there any logic in the location of established county and municipal boundary lines. Community interests and community development frequently break over these lines. So do important planning problems. Wherever this happens to any large extent there are likely to be decisive advantages and economies in having one planning commission instead of two or three or a dozen at work.

Rural counties with extensive submarginal land-use problems, may find particular advantage in combining forces in planning and zoning as will also groups of urban municipalities, without definite physical demarcations between them. Consolidation of the planning functions of two or more closely related counties or municipalities, also will

give many of the benefits usually sought through political annexations or consolidations. Where political annexation or consolidation is the recognized ultimate solution, but difficult of immediate accomplishment, planning on a regional basis may pave the way to the more complete governmental unity by developing the habit of cooperative action between municipalities.

Powers and Duties of Regional Commissions

Under joint or regional planning procedure, the participating governmental units retain all their independent legislative functions. The regional planning commission makes a master plan for all territory under its jurisdiction. It regulates land subdivision activities for the entire area. It maintains the integrity of the plan by means of all the powers conferred by the planning enabling acts upon individual municipal and county planning commissions. It may be authorized to prepare a zoning ordinance and plan for the entire area. But adoption of their respective portions of the regional zoning ordinance and plan rests with the legislative bodies of the individual component political units, in independent action. Zoning administration also remains an individual responsibility, with each governmental agency having its own zoning officer and its own board of adjustment. Powers and duties of the regional planning commissions also may be limited or cut short of those provided by the enabling acts, to whatever degree may be agreed upon by the cooperating governmental agencies. In other words, the regional board may be given any or all the authority conferred upon individual planning commissions.

Personnel and Its Appointment; Joint Planning Organization

"The number and qualifications of the members of any such regional planning commission and their terms and method of appointment or removal shall be such as may be determined and agreed upon by said cooperating authorities and county commissioners provided, however, that a majority of the members of the regional planning commission shall hold no other public office or position excepting appointive membership on a municipal or other planning commission."

For best workability the regional planning commission should not have more than nine members. However, proper representation from all participating units is more important than keeping the planning body down to most efficient size. If there are several cooperating political subdivisions it probably will be found desirable to increase proportionately the total number of regional planning commission members. Usually, the commission should include representation from each of the participating governmental bodies. Citizen members should be selected for prestige in their respective communities and for good-will and well-informed judgment rather than for possible technical planning skill or experience, for, as in the case of county and municipal planning commissions, the regional planning commission must not be expected to do the actual survey and plan-making job. Its proper function is that of guidance and general direction and of policy making, implemented by adequate funds and technical staff.

Compensation and Financing under Joint or Regional Planning

Members of the regional planning commission serve without salary but they may be reimbursed for necessary expenses incurred in the performance of their duties.

Funds for use of the commission may be appropriated by the participating governmental units in whatever proportion and total amount may be agreed upon by them. Within such appropriated funds, the commission may employ whatever staff and technical assistance may be required, and incur other necessary expenses.

Planning and Administrative Procedure

Planning procedures and problems to be encountered are not essentially different for the regional planning commission than for the planning commission of an individual county or municipality. The discussion of planning and zoning procedures in the foregoing chapters, therefore, is equally applicable to regional planning and regional zoning. For regional planning commissions

serving groups of urban municipalities, however, procedures will be as for city planning commissions rather than as for county planning commissions.

The regional planning commission does have a rather special tactical problem in that it must serve and must deal with several community groups and several governing bodies instead of with one. This problem will vary with each region according to its nature and composition and with the regional objectives. Methods for handling it can best be determined on the ground in each instance and are scarcely subject to general suggestion. The problem is one to be solved largely by tact, well-informed action, good politics, and education.

In defining logical regional planning areas, the State Planning Board is available for assistance to groups of counties or groups of municipalities.

Mapping; Base Maps

The type of maps needed for regional planning will depend upon the characteristics of the region involved. Base maps at scales as large as one inch equals 200 feet should be made for urbanized portions of the region. A scale of one inch equals 2,000 feet would be suitable for rural portions. Mosaics of air photographs and existing use maps at suitable scales are essential. The State Planning Board should be consulted about the types of maps required for any specific region.

Regional Cooperation in Planning

The official regional planning commission represents a rather advanced stage of organization for planning. In many localities, the creation of this official planning body may be difficult of immediate accomplishment. When local planning commissions exist or can be created within such regions, these local commissions can accomplish much toward coordination and unification of plans by unofficial cooperation, including frequent joint meetings. Such unofficial cooperation upon the part of neighboring local planning agencies is strongly urged as a procedure almost certain to be of great mutual benefit.

Chapter VII

PLANNING AND ZONING INTERRELATIONSHIPS; STATE, COUNTY, AND MUNICIPAL

All units of government in Pennsylvania now have authority to zone and all but townships of the second-class have specific authority to plan and to exercise more or less extensive planning controls. Further, groups of municipalities, groups of counties, and groups of counties and municipalities are authorized to proceed with planning and zoning jointly, under single or joint planning and zoning commissions.

Considerable care has been taken in framing the several enabling acts to avoid conflicting and overlapping functions and jurisdictions. For the most part, there is clear distinction between the powers and duties of the several different kinds of planning agencies.

Levels of Public Planning

A natural first question is, why so many different planning commissions? If there is a State Planning Board, why are county planning commissions needed? If there is a county planning and zoning commission, why should there be need for city, borough, and township planning and zoning commissions? The answer is that for every unit of government charged with rendering public service and with developing the facilities therefor, there is a parallel planning function which, under our system of government, seems best to be performed by some kind of a planning commission. There is little reason for conflict or overlapping if each commission stays within a range of activity corresponding to that of the governmental unit to which it is attached. This is, in large part, provided for by law, but may be further assured by

self-imposed limitation upon scope of activities, by the planning commission itself. Since planning commissions in Pennsylvania have only advisory powers, except in platting controls, overlapping of planning studies, should they occur, are not especially serious except in that they make for inefficiency and confusion.

Real Estate Platting Control

Subdivision control powers of third-class city planning commissions, in their extension to the territory within three miles of the city limits, do carry some possibility of conflict. The law specifically provides that, in case of an overlapping of the three-mile territory between neighboring municipalities, the jurisdiction of each planning commission shall extend to a point equidistant between the two municipalities. This is clear enough. But the County Planning Enabling Act now confers platting control authority upon county planning commissions for all territory outside of the corporation limits of boroughs and cities. Literal interpretation of the county and the third-class city planning enabling acts specifies that plat maps, for land subdivisions outside of but within three miles of city limits of third-class cities with planning commissions, must be approved by both the county planning commission, if such exists, and by the city planning commission.

Since there are at present relatively few county planning commissions these provisions have caused no serious conflict of authority.

Relation of State Planning Board to Component Governmental Units

In discussing the normal inter-relationships of planning and zoning bodies in Pennsylvania, we shall start with the function of the State Planning Board in its relation to county and municipal planning and zoning commissions.

The State Planning Board is charged with making a comprehensive development plan for the State. This planning includes only major development projects, principally such as are within the jurisdiction of one or another State department, or

such matters as concern the long-range economy of the State. Such planning will in a sense provide a broad structural framework for the guidance of county and municipal plans.

The State Planning Board has the further legislated function of giving general guidance and assistance to local planning boards and of helping to coordinate local plans. The State Planning Board has no authority or intention of entering either counties or municipalities to make or to impose county or municipal plans of a description falling within the jurisdiction of local planning bodies.

Relation of County to Its Component Governmental Units

The County Zoning Enabling Act provides that all county zoning ordinances shall be submitted to the State Planning Board, for review, prior to adoption. This is to assure that the locality has the benefit of general advice from the State Planning Board but the locality is under no compulsion to accept this advice.

County planning commissions, in turn, are charged with the responsibility of making county-wide plans and of assisting city, borough, and township planning undertakings, but have no authority to make local plans. Boroughs and third-class cities may prepare plans for territories within three miles of borough and city limits, an area which is also covered by a county plan. Adjustment of conflicting plans within such areas must be by friendly cooperation between the county and local planning boards. In the last analysis, decisions will rest with the authority responsible for the construction and maintenance of whatever projects may be in controversy.

Recording of Zoning Ordinances and Building Codes with County Recorder of Deeds

In the 1949 Session of the General Assembly two acts were passed which imposed certain responsibilities upon the Recorder of Deeds of each county and upon all municipalities which have been authorized to adopt zoning ordinances and building codes.

Act 400, approved May 14, 1949, requires that every political sub-division which had adopted a zoning ordinance before that date, or which thereafter adopts or amends such an ordinance, must file with the county Recorder of Deeds a copy of the zoning ordinance and map and that the Recorder must provide a suitable book or books in which the copy of such ordinances or amendments together with the map shall be kept. He shall charge a suitable registration fee but must maintain an index of the ordinances filed in his office. Failure to file ordinances existing as of May 14, 1949 before November 14, 1949 has rendered them void and of no effect. Ordinances or amendments to ordinances thereafter adopted are invalid until filed.

By Act 462 of 1949, the same provisions are applied to building ordinances or codes, or amendments thereto and the same duties imposed on the county Recorders of Deeds to provide a suitable Building Ordinance book or books in which the copy of any such building ordinances shall be kept. This book also must be suitably indexed. The Recorder of Deeds is authorized to charge the political sub-division filing copies of its building ordinances a fee equal to the fees authorized by law for the same or similar services. The final date for the filing of building ordinances existing as of May 20, 1949 was November 20, 1949.

Chapter VIII

PLANNING AND ZONING ENABLING LEGISLATION

First, second, and third-class cities, boroughs, and townships of the first class, in Pennsylvania, have had planning and zoning enabling legislation for many years.

Under the County Planning Act, and more specifically under acts of the General Assembly of 1943 and 1945, groups of adjoining municipalities may combine planning forces by proceeding jointly under a regional planning commission.

Definition and Scope of Urban Planning.

The planning and zoning laws for counties, for townships of the second class and for joint or regional planning commissions, and the required planning and zoning procedures for these units of government, are outlined in Volume I of this series. These will not be further discussed here except as they may relate to urban planning. Planning and zoning for Pennsylvania's first-class and second-class cities are covered by separate legislation and, therefore, are not included in this generalized statement.

The following is a brief outline of the several principal provisions of the Enabling Acts governing planning and zoning by regions, by third-class cities, boroughs, and townships of the first class. Full text of the several State Enabling Acts will be found in the Appendices.

Third-Class City Planning Enabling Act, — No. 317, 1931 P. L. 932, Article XL.

Requirement that Third Class Cities Must Plan, and Procedures Provided.

1. *Authority:*

   City Council must appoint a Planning Commission of five members.

2. *Composition and Nature of Planning Commission:*

   a. Members shall reside in city or within three miles of city limits.

   b. Members may hold any office under City Government except that of Mayor or of member of Council.

   c. Members of the Commission shall serve without salary.

3. *Powers and Duties of the Planning Commission:*

   a. May employ engineers and other assistants within funds appropriated by City Council.

   b. May make and may publish maps and plans of city or any portion thereof, including territory extending three miles beyond city limits, showing existing and proposed streets and highways, parks and parkways, playgrounds, public building locations and other public grounds and public improvements.

   c. May make recommendations to any public authorities, to any corporation, or to any individual within its jurisdiction, with reference to any building or works to be constructed by them.

   d. Wherever a county or city urban redevelopment authority has been appointed, the planning commission must designate areas needing redevelopment, and supply plans and recommendations for the rehabilitation of such areas.

   e. Shall regulate land-subdivision activities within city area and in territory within three miles of city limits. No plat map or subdivision plan shall be received or recorded in any public office unless bearing the endorsed approval of the Planning Commission. No public improvement or public-service facility shall be authorized or made for any subdivision within the jurisdiction of the Planning Commission until the plat map has been approved by the Planning Commission.

      In case of an over-lapping of the three-mile extra-territorial jurisdiction of Planning Commissions for neighboring cities, the limit of jurisdiction for each Commission is placed at a point equi-distant between the boundary lines of the two cities.

f. May make zoning recommendations as provided by Section 4111, Article XLI, of this Act.

g. The Planning Commission shall make annual report to City Council.

4. *Effect of Planning Commission Recommendations:*

The clerk of Council, upon introduction of proposed ordinances and bills relating to the location, construction, or change of any public improvement or public property, shall furnish the Planning Commission with a copy thereof.

The Planning Commission shall have the power to disapprove any of said proposed ordinances or bills, but must communicate its disapproval to Council within one week of introduction of said ordinances. Disapproval by the Planning Commission, however, shall not operate as a veto.

5. Other administrative units of city government may be designated as the Planning Commission.

Action, either in creating a planning commission or in performing its functions should be taken only after close study of the Enabling Act itself.

It will have been observed that the Planning Commission in third-class cities is entirely advisory except in the matter of land-subdivision regulation, where it has final jurisdiction.

The Act, does not provide for the adoption by City Council of an "official city map," as do the laws of some other states. Provisions of other third-class-city laws, however, require the adoption of a city map showing existing and proposed streets, thus accomplishing much the same purpose.

Third-Class-City Zoning Enabling Act,—No. 317, 1931, P.L. 932, Article XLI, Part (b).

Grant of Power to Third-Class Cities to Zone and Provided Procedures.

1. *Authority:*

Third class "cities may, by ordinance, regulate and restrict the height, number of stories, bulk, and size of buildings and other structures, the percentage of lots that may be occupied, the size, depth, and width

of yards, courts, and other spaces, the density of population, and the location and use of buildings, structures and land, for trade, industry, residence, or other purposes, and may make different regulations for different districts thereof. . . ."

2. *Prescribed Procedure in Preparation and Adoption of Ordinance:*

   a. The City Planning Commission, or a committee of Council, or such other commission or committee as may be created by Council for the purpose, shall recommend to Council the boundaries of districts and the appropriate regulations and restrictions to apply therein.

   b. Before making its final report and recommendations to Council, the zoning body shall hold public hearings on its tentative recommendations.

   c. After receiving the final report from the zoning body, and prior to its adoption, Council shall hold a public hearing, after notice thereof published in a daily paper of local circulation for ten consecutive days.

   d. Subsequent to original enactment of the zoning ordinance, and after public notice and hearing, Council may make amendments thereto. However, in case of a protest signed by owners of twenty percent of the frontage within a distance, specified by law, a three-fourths vote of Council is required to make the change.

   e. All zoning ordinances and amendments must be recorded with the county Recorder of Deeds.

3. *Special Provision:*

   Exemption of necessary buildings used by public-service corporations.

4. *Administration:*

   a. The appointment by Council of an administrative or zoning officer is assumed.

   b. Appointment of a Board of Appeals by Council is required.

   c. The Board of Appeals shall consist of three members.

d. The Board of Appeals shall adopt rules and regulations in accordance with the provisions of the zoning ordinance.

e. Meetings of the Board of Appeals shall be open to the public and its proceedings shall be a public record.

f. The Board of Appeals shall have these powers:

(1) To hear and decide appeals where it is alleged there is error in any order, requirement, decision, or determination made by an administrative official in the enforcement of the provisions of the zoning ordinance.

(2) To hear and decide special exceptions to the terms of the zoning ordinance upon which the Board is required to pass under such ordinance.

(3) To authorize upon appeal in specific cases such variance from the terms of the zoning ordinance as will not be contrary to the public interests where, owing to special conditions, a literal enforcement of the provisions of the zoning ordinance will result in unnecessary hardships, so that the spirit of the ordinance shall be observed and substantial justice done.

5. *Recourse Open to Property Owners:*

a. Protest at required public hearings held by the zoning body and by Council.

b. Power of petition against amendment of the zoning ordinance.

c. Right of appeal to the Board of Appeals for specific exceptions to the literal enforcement of the ordinance.

d. Right to present case to the County Court of Common Pleas when aggrieved by any action of the Board of Appeals.

Third-Class-City Authority to Establish Uniform Building Lines,—No. 317, 1931, P.L. 932, Article XLI, Part (c), Section 4115.

Grant of Power to Third-Class Cities to Establish Uniform Building Lines.

1. *Authority to Plan:*

"Cities may establish and maintain uniform building

lines upon any or all public streets, roads, highways, lanes and alleys of the city."

2. *Procedure:*

No specific procedure is provided in the Act. It may be assumed that building lines may be established either by special action of council by incorporation of such establishments in the official city map, or by the inclusion of building-line provisions in the zoning ordinance.

By whatever action of Council building lines are put into effect, they should be consistent with and an integral part of the comprehensive city plan and, therefore, are properly to be included among the studies and recommendations of the City Planning Commission.

Grant of Power to Boroughs to Plan.

Borough Planning Enabling Act,—No. 568, 1947, P.L. 1621, Part (h), Sections 1145 to 1150.

1. *Creation of Borough Planning Commission:*

Burgess and Council of any Borough may establish a Department of Borough Planning which shall be in charge of a Borough Planning Commission.

2. *Composition and Nature of Borough Planning Commission:*

a. Five members, to be appointed by Council.

b. Members shall reside within "jurisdiction of the Planning Commission."

c. Initial terms of members shall vary as provided by the Enabling Act but ultimate terms of all members shall be five years.

d. Members shall serve without compensation but may be reimbursed for necessary expenses.

3. *Powers and Duties of the Borough Planning Commission:*

a. May make rules and regulations governing its organization and procedures.

b. May employ engineers and other assistants, within funds appropriated to its use by Council.

c. Shall receive copies of all ordinances of Council for the location, construction, or alteration of public works. May file disapproval of any such ordinance with Council, within ten days. But such disapproval shall not operate as a veto upon action of Council.

d. May make and cause to be published maps of the Borough and territory within three miles of the Borough limits,—these maps to show existing and proposed streets, parks, playgrounds, public building sites and other public properties, together with proposed alterations.

e. May make recommendations to any public authority, or corporation or individual with reference to building or works to be constructed by them within the area of Planning Commission jurisdiction.

f. Every plat map or subdivision plan for laying out land, within the Borough limits, into building lots and streets shall be submitted, by the land subdivider, to the Planning Commission for approval. It shall be unlawful to receive or record any plat map in any public office except it bear the endorsed approval of the Planning Commission for the Borough in which the land is located. No public improvement shall be voted by Council or other public body, for lands shown on any plat map which has not been approved by the Borough Planning Commission.

4. *Alternative Borough Planning Authority:*

All powers of a Borough Planning Commission, under this Act, may be conferred upon a Borough Park Commission or a kindred municipal bureau or commission authorized under existing laws.

Borough Zoning Enabling Act,—No. 568, 1947, P.L. 1621. Article XXXIII.

Grant of Power to Boroughs to Zone.

1. *Authority:*

Boroughs are authorized to adopt and enforce zoning ordinances regulating: the location, construction and use of buildings; the size of courts and open spaces; the density of population, and the use of land. And for said purposes to:

a. Divide the Borough into districts of such number, shape, and area as are suited to carry out the purposes of the Act.

b. Frame governing regulations for the several districts, in accordance with a comprehensive Borough Plan. These regulations shall be designed so as to "lessen congestion in the streets; to secure safety from fire, panic, and other dangers; to promote health and general welfare; to provide adequate light and air; to prevent overcrowding of land; to avoid undue concentration of population; to facilitate the adequate provision of transportation, water, sewerage, schools, parks, and other public requirements. Such regulations shall be made with reasonable consideration, among other things, to the character of the district and its peculiar suitability for particular uses and with a view to conserving the value of buildings and encouraging the most appropriate use of land throughout such municipality."

2. *Procedure:*

a. Council shall appoint a Zoning Commission of five members. Where a Borough Planning Commission already exists, it may be designated as the Zoning Commission.

b. The Zoning Commission shall prepare a proposed Borough zoning ordinance and plan including indication of number of districts and district boundary lines and regulations to govern in each district, for recommendation to Borough Council.

c. The Zoning Commission shall make a preliminary report covering its recommendations and shall hold public hearings thereon prior to submitting its final report and recommendations to Borough Council.

d. Council may proceed to consider and to act upon the proposed zoning ordinance and plan as recommended by the Zoning Commission. But, prior to adoption of the ordinance, Council shall hold a public hearing, notice of the time and place of which hearing shall be published in an official paper or newspaper of general circulation in the Borough, at least fifteen days in advance of date of said hearing.

e. Council may amend the proposed zoning ordinance any time subsequent to its adoption after due notice and hearing. In case, however, of a protest signed by owners of twenty percent of the land within a specified distance of the area to be changed, Council may not make the change except upon a favorable three-quarters vote of its membership.

f. Provisions of the zoning ordinance need not be advertised in full as in other cases. The ordinance may be adopted by reference to a typed or printed copy which shall be made available to any interested party at the cost thereof, or may be furnished or loaned without charge. A copy shall be attached to the ordinance book with the same force and effect as if duly recorded therein. Ordinance must be recorded with county Recorder of Deeds.

3. *Special Provisions:*

Buildings used by public service corporations are exempted from ordinance regulations when declared, by the Public Utility Commission, to be a public necessity.

4. *Administration:*

a. Council may appoint a Zoning Board of Adjustment of three members, to assist in administration of the zoning ordinance.

b. Procedures to be followed by the Board of Adjustment are detailed in the Act.

c. Powers of the Board of Adjustment shall be:
(1) To hear and decide appeals where it is alleged there is error in any order, requirement, decision, or determination made by an administrative official in the enforcement of this act or of any ordinance adopted pursuant thereto;
(2) To hear and decide special exceptions to the terms of the zoning ordinance upon which such board is required to pass under such ordinance;
(3) To authorize, upon appeal, in specific cases, such variance from the terms of the zoning ordinance as will not be contrary to the public interest, where, owing to special conditions, a literal enforcement of the provisions of the ordinance will result in unnecessary hardship; in order that

the spirit of the ordinance shall be observed and substantial justice done in such adjustment.

d. Zoning officer is not provided for specifically. No special provision is made in the Act as to appointment and powers and duties of an administrative official. Such an officer, however, is necessary for the issuance of permits and for checking upon observance of the ordinance.

4. *Recourse Open to Property Owners:*

a. Opportunity to be heard at public hearings required to be held by the Zoning Commission and by Council prior to adoption of the ordinance.

b. Right of appeal to the Board of Adjustment for interpretation of the zoning ordinance and for exceptions in cases of demonstrable unusual hardships occasioned by its operation.

c. Right of appeal to any court of record in case of grievance due to any decision of the Board of Adjustment.

d. Right of protest against amendments to the zoning ordinance, requiring a favorable three-quarters vote of Council to make a change.

Grant of Power to First-Class Townships to Plan.

First-Class Township Planning Enabling Act,—No. 569, 1949, Article XXXII.

1. *Authority:*

The Township Commissioners may create, by ordinance, and appoint a Township Planning Commission.

2. *Composition and Nature of Township Planning Commission:*

a. It shall consist of five persons resident in the Township.

b. Initial terms of members vary as provided by the Act, but ultimate terms are for five years.

c. Members shall serve without compensation but may be reimbursed for necessary expenses.

3. *Powers and Duties:*

a. The Planning Commission may, with consent of the Township Commissioners, employ engineers and other assistants, within such funds as may be appropriated to its use by the Township Commissioners and may contract for professional planning services.

b. Shall make, or cause to be made, maps and plans of the Township showing existing and proposed streets, parks, playgrounds and other public grounds and improvements, and any proposed alteration thereof. May recommend subsequent changes of said maps and plans.

c. The Township Commissioners may, at their discretion, from time to time submit to the Planning Commission questions or proposals relating to public improvements in the Township and it shall be the duty of the Planning Commission to make a report and recommendations with respect thereto.

d. Although Planning Commissions of First Class Townships do not have the power to control land sub-divisions, which power now rests with the Township Commissioners, the Commissioners are authorized to refer plans of sub-divisions to the Planning Commission for recommendations when lots abut existing streets of insufficient width, or streets proposed to be laid out through unimproved land. (Article XXX A, P. L. 362, 1947.)

First-Class Township Zoning Enabling Act,—No. 569, 1949, Article XXXI.

Grant of Power to First-Class Townships to Zone.

Authorizes Township Commissioners of Townships of the first class to create Zoning Commissions and to enact zoning ordinances.

Terms of the Act and procedures to be followed are similar to those for boroughs, as outlined above.

The Township Commissioners are empowered to appropriate money to finance the work of the Zoning Commission and the Board of Adjustment and for the enforcement of zoning regulations and restrictions.

Grant of Power for Cooperative Exercise of Government Function.

Regional Planning and Zoning Enabling Act,—No. 434, 1937, P.L. 2124, Sec. 507.2 to 507.4; Amended 1943, P.L. 340 and 1945 P.L. 206 and P.L. 1339.

1. *Authority:*

   "Two or more adjoining municipalities may jointly cooperate in the exercise and in the performance of their respective governmental powers, duties and functions and in carrying into effect provisions of law relating to said subjects which are common to all of such adjoining municipalities, and which each may, under existing law, separately exercise and perform.

2. *Composition and Nature of Regional Planning Commission:*

   a. The number and qualifications of members are to be determined by cooperating authorities, provided that the majority shall not be public officials other than appointive local planning commission members.

   b. The members shall serve without salary.

   c. The chairman shall hold no public office other than to be an appointed municipal planning commission member.

3. *Powers and Duties of the Planning Commission:*

   a. To employ staff and technical assistance within the funds duly appropriated for the commission.

   b. To make studies and surveys essential for the development of a regional plan, and to develop agreements among municipalities for the cooperative performance of their respective governmental powers, duties and functions.

APPENDICES

CITY PLANNING COMMISSION ENABLING ACT

Act No. 317, 1931. P. L. 932
The Third Class City Law

Article XL

CITY PLANNING

Section 4001. City Planning Commission; Appointment of Comissioners; Vacancies; Powers.—A city planning commission, consisting of five persons to be appointed by the city council, is hereby created. In the first instance, one member of said commission shall be appointed for one year; one, for two years; one, for three years; one, for four years; and one, for five years. Annually thereafter a member of said commission shall be appointed for a term of five years. An appointment to fill a casual vacancy shall be only for the unexpired portion of the term. All members of the said commission shall reside within the zone of jurisdiction of said commission, as hereinafter defined. No person holding office under the government of the city, except the mayor or other members of council shall be ineligible to serve as a member of the city planning commission. The commission may make and alter rules and regulations for their own organization and procedure, consistent with the ordinances of the city and the laws of the Commonwealth. The members of the commission shall serve without compensation, and make annually to the council a report of their transactions. The commission may employ engineers and other persons, whose salaries and wages, and other necessary expenses of the commission, shall be provided for by appropriations of council.

Section 4002. Action on Ordinances Relating to Public Buildings, Streets, Parks, Bridges, Et Cetera.—The clerk of council shall, upon introduction, furnish to the city planning commission, for its consideration, a copy of all ordinances and bills, and all amendments thereto, relating to the location of any public building of the city; to the location, extension, widening, narrowing, enlargement, ornamentation, and parking of any street, boulevard, parkway, park, playground, or other public ground; to the relocation, vacation, curtailment, changes of use, or any other alteration of the city plan, with relation to any of the same; and to the location of any bridge, tunnel and subway, or any surface, underground, or elevated railway. The commission shall have the power to disapprove any of the said ordinances, bills, or amendments, which disapproval, however, must be communicated to council, in writing, within one week from the introduction of said ordinances, but such disapproval shall not operate as a veto.

Section 4003. Maps of City and Environs; Recommendations to Council.—The city planning commission may make, or cause to be made, and lay before council, and, at its discretion, cause to be published, maps of the city or any portion thereof, including terirtory extending three miles beyond the city limits, showing the streets and highways and other natural and artificial features, and also locations proposed by it for any new public buildings, civic centre, street, parkway, park, playground, or any other public ground or public improvement, or any widening, extension, or relocation of the same, or any change in the city plan by it deemed advisable. It may make recommendations to council, from time to time, concerning any such matters and things aforesaid, for action by council; and, in so doing, it shall have regard for the present conditions and future needs and growth of the city, and the distribution and relative location of all the principal and other streets and railways, waterways, and all other means of public travel and business communications, as well as the distribution and relative location of all public buildings, public grounds, and open spaces devoted to public use.

Section 4004. Recommendations to Public Authorities, Corporations and Individuals.—The city planning commission may make recommendations to any public authorities, or any corporations or individuals in said cities, with reference to the location of any buildings, structures, or works to be erected or constructed by them.

Section 4005. Approval of Plans of Building Lots; Conflict of Jurisdiction.—All plans, plots, or re-plots of lands laid out in building lots, and the streets, alleys, or other portions of the same intended to be dedicated to public use, or for the use of purchasers or owners of lots fronting thereon or adjacent thereto, and located within the city limits, or for a distance of three miles outside thereof, shall be submitted to the city planning commission and be approved by it before it shall be recorded. No unapproved plan shall be received or recorded in any public office unless the same shall bear thereon, by endorsement or otherwise, the approval of the city planning commission. The disapproval of any such plan by the city planning commission shall be deemed a refusal of the proposed dedication shown thereon. The approval of the commission shall be deemed an acceptance of the proposed dedication; but shall not impose any duty upon the city concerning the maintenance or improvement of any such dedicated parts, until the proper authorities of the city shall have made actual appropriation of the same by acceptance, entry, use, or improvement. No sewer, water, or gas main, or pipes, or other improvements, shall be voted or made within the area under the jurisdiction of said commission, for the use of any such purchasers or owners; nor shall any permit for connection with or other use of any such improvement existing, or for any other reason made, be given to any such purchasers or owners until such plan is approved. Where the jurisdictional limit of three miles outside of the city limits, as provided in this section, may conflict with the zone of similar character connected with another municipality, the jurisdiction of said commission shall extend only to the point equidistant between the city limits and the limits of said municipality.

Section 4006. Jurisdiction may be Transferred to Other Municipal Bureau or Commission.—Cities may provide, by ordinance, for the exercise of all rights and powers herein conferred upon the city planning commission, by a park commission, or kindred municipal bureau or commission, authorized under existing laws.

CITY ZONING AND BUILDING REGULATIONS ENABLING ACT

Act No. 317, 1931. P. L. 932
The Third Class City Law

ARTICLE XLI

(b) ZONING

Section 4110. Power to Regulate and Restrict Building Operations; Districts.—Cities may, by ordinance, regulate and restrict the height, number of stories, bulk, and size of buildings and other structures, the percentage of lots that may be occupied, the size, depth, and width of yards, courts, and other open spaces, the density of population, and the location and use of buildings, structures and land for trade, industry, residence, or other purposes, and may make different regulations for different districts thereof, and may alter the same; but no alteration of such regulations may be made, except by the affirmative vote of not less than four of the members of council. Such regulations shall provide that a board of appeals may determine and vary their application in harmony with their general purpose and intent, and in accordance with general or specific rules therein contained.

Section 4111. Recommendations of Regulations to Council; Hearings; Adoption; Changes.—The city planning commission, where such bodies exist, or a committee of the council, or such other commission or committee as may be created by the council for the purpose, shall recommend to the council the boundaries of districts and appropriate regulations and restrictions to be imposed therein. Such body shall make a tentative report, and hold public meetings thereon, before submitting its final report. At such time as the council may require, after such final report, council shall afford persons affected an opportunity to be heard, at a time and place to be specified in a notice of hearing to be published for ten consecutive days in a daily newspaper or newspapers of general circulation in said city. Council shall not determine the boundaries of any district, nor impose any regulations or restrictions, until after the final report and after said hearing.

Council may, from time to time, after public notice and hearing, amend, supplement, or change such regulations, restrictions, or district boundaries. If a protest against a proposed amendment, supplement, or change be presented, duly signed, by the owners of twenty per centum, or more, of the frontage proposed to be altered, or by the owners of twenty per centum of the frontage immediately in the rear thereof, or by the owners of twenty

per centum of the frontage directly opposite the frontage proposed to be altered, a three-fourth vote of the members of council shall be required to adopt such proposed amendment, supplement, or change.

Section 4112. Exemption of Public Service Corporation Buildings.—The foregoing sections of this article shall not apply to any existing or proposed building, or extension thereof, used or to be used by public corporations, if upon petition of the corporation, the Public Service Commission shall, after a public hearing, decide that the present or proposed situation of the building in question is reasonably necessary for the convenience or welfare of the public.

Section 4113. Board of Appeals.—Council shall appoint a board of appeals, and, in the regulations and restrictions adopted pursuant to the authority of this subdivision (b) of this article, shall provide that the board of appeals may, in appropriate cases, and subject to appropriate conditions and safeguards, make special exceptions to the terms of the ordinance, its supplements and amendments, in harmony with its general purpose and intent, and in accordance with general or specific rules therein contained.

The board of appeals shall consist of three members, one of whom shall be appointed to serve until the first Monday of January following the adoption of the zoning ordinance; one, until the first Monday of the second January thereafter; and one, until the first Monday of the third January thereafter. Their successors shall be appointed, on the expiration of their respective terms, to serve three years. The appointing authority, upon written charges, shall have the power to remove any member for cause, and after public hearing. Vacancies shall be filled for the unexpired term of any member whose place becomes vacant.

The board shall adopt rules in accordance with the provisions of any zoning ordinance adopted. Meetings of the board shall be held at the call of the chairman and at such other times as the board may determine. Such chairman, or in his absence, the acting chairman may administer oaths and compel the attendance of witnesses. All meetings of the board shall be open to the public. The board shall keep minutes of its proceedings showing the vote of each member upon each question, or if absent or failing to vote, indicating such fact, and shall keep records of its examinations and other official actions. Every rule or regulation, every amendment or repeal thereof, and every order, requirement, decision, or determination of the board shall immediately be filed in the office of the board and shall be a public record.

The board of appeals shall have the following powers:

1. To hear and decide appeals where it is alleged there is error in any order, requirement, decision, or determination made by an administrative official in the enforcement of the provisions of this subdivision or of any ordinance adopted pursuant thereto.

2. To hear and decide special exceptions to the terms of the ordinance upon which such board is required to pass under such ordinance.

3. To authorize upon appeal in specific cases such variance from the

terms of the ordinance as will not be contrary to the public interest where, owing to special conditions, a literal enforcement of the provisions of the ordinance will result in unnecessary hardships, so that the spirit of the ordinance shall be observed and substantial justice done.

In exercising the above mentioned powers, such board may, in conformity with the provisions of this subdivision (b) of this article, reverse or affirm, wholly or partly, or may modify, the order, requirement, decision or determination appealed from, and may make such order, requirement, decision, or determination as ought to be made, and, to that end, shall have all the powers of the officer from whom the appeal is taken.

Such board of appeals shall also hear and decide appeals from and review any order, requirement, decision, or determination made by an administrative official charged with the enforcement of any zoning ordinance. It shall also hear and decide all matters referred to it or upon which it is required to pass under any such ordinance. Such appeal may be taken by any person aggrieved or by any officer, department, board, or bureau of the city affected by the decision of the administrative officer.

Such appeal shall be taken within a reasonable time as provided by the rules of the board, by filing with the officer from whom the appeal is taken, and with the board of appeals a notice of appeal specifying the grounds thereof. The officer from whom the appeal is taken shall forthwith transmit to the board all the papers constituting the record upon which the action appealed from was taken.

An appeal stays all proceeding in furtherance of the action appealed from, unless the officer from whom the appeal is taken certifies to the board of appeals, after the notice of appeal shall have been filed with him, that by reason of facts stated in the certificate, a stay would in his opinion cause imminent peril to life or property. In such case proceedings shall not be stayed otherwise than by a restraining order, which may be granted by the board of appeals or by a court of record on application, on notice to the officer from whom the appeal is taken and on due cause shown.

The board of appeals shall fix a reasonable time for the hearing of the appeal, give public notice thereof as well as due notice at least six days prior to the hearing, by mail, to the parties in interest at the address filed with the appeal, and decide the same within a reasonable time. Upon the hearing any party may appear in person or by agent or by attorney.

Any person or persons jointly or severally aggrieved by any decision of the board of appeals, or any taxpayers, or any officer, department, board, or bureau of the municipality may present to the court of common pleas of the respective county a petition duly verified, setting forth that such decision is illegal in whole or in part, specifying the grounds of the illegality. Such petition must be presented to the court within thirty days after the filing of the decision in the office of the board.

Upon the presentation of such petition, the court may allow an appeal directed to the board of appeals, to review such decision of the board of appeals, and shall prescribe therein the time within which a return thereto must be made and served upon the relator's attorney, which shall not be less than ten days and may be extended by the court. The allowance of the writ shall not stay proceedings upon the decision appealed from, but

the court may, on application on notice to the board and on due cause shown, grant a restraining order

The board of appeals shall not be required to return the original papers acted upon by it, but it shall be sufficient to return certified or sworn copies thereof or of such portions thereof as may be called for by such writ. The return shall concisely set forth such other facts as may be pertinent and material to show the grounds of the decision appealed from, and shall be verified.

If upon the hearing it shall appear to the court that testimony is necessary for the proper disposition of the matter, it may take evidence or appoint a referee to take such evidence as it may direct and report the same to the court with his findings of fact and conclusions of law, which shall constitute a part of the proceedings upon which the determination of the court shall be made. The court may reverse, or affirm wholly or partly, or may modify the decision brought up for review.

Costs shall not be allowed against the city unless it shall appear to the court that it acted with gross negligence, or in bad faith, or with malice in making the decision appealed from.

All issues in any proceeding under this section shall have preference over all other civil actions and proceedings.

REVISED TEXT OF "BOROUGH PLANNING COMMISSION ENABLING ACT"

Act No. 336, 1927. P. L. 519
Revised in Borough Code, approved July 10, 1947,
Sections 1145 to 1150

AN ACT

Concerning boroughs, and revising, amending, and consolidating the law relating to boroughs.

(h) BOROUGH PLANNING COMMISSION

Section 1145. Creation of Borough Planning Department; Appointment of Commissioners; Powers; No Compensation.—The council of any borough may at any time create by ordinance a department to be known as the Department of Borough Planning, which shall be in charge of a Borough Planning Commission consisting of five persons to be appointed by council. In the first instance one member of said commission shall be appointed for one year, one member for two years, one member for three years, one member for four years, and one member for five years, and, annually thereafter, a member of said commission shall be appointed for a term of five years. An appointment to fill a vacancy shall be only for the unexpired portion of the term. All members of the said commission shall reside within the zone of jurisdiction of said commission as hereinafter defined. They may make and alter rules and regulations for their own organization and

procedure, consistent with the ordinances of the borough and the laws of the Commonwealth. They shall serve without compensation, and make annually to the council a report of their transactions. They may employ engineers and other persons, whose salaries and wages, and other necessary expenses of the commission, where approved by council, shall be provided for through proper appropriation by council. They may contract for professional planning services, the costs and expenses of which, when approved by council, shall be provided for through proper appropriation by council.

Section 1146. Commission to Receive Copies of Ordinances; Action Thereon.—The secretary of council shall, upon introduction, furnish to the Borough Planning Commission for its consideration a copy of all proposed ordinances and all amendments thereto, relating to the location of any public building of the borough, and to the location, extension, widening, narrowing, enlargement, ornamentation, and parking of any street, boulevard, parkway, park, playground, or other public ground, and to the relocation, vacation, curtailment, changes of use, or any other alteration of the borough plan with relation to any of the same, and to the location of any bridge, tunnel, and subway, or any surface, underground, or elevated railway. The said commission shall have the power to disapprove any of the said ordinances, bills or amendments, which disapproval, however, must be communicated to council in writing within ten days from the introduction of said ordinances, but such disapproval shall not operate as a veto.

Section 1147. Maps; Recommendations.—The Borough Planning Commission may make, or cause to be made, and lay before council, and, at its discretion cause to be published, maps of the borough or any portion thereof, including territory extending three miles beyond the borough limits, showing the streets and highways, and other natural and artificial features, and also locations proposed by it for any new public buildings, civic center, street, parkway, park, playground, or any other public ground or public improvement, or any widening extension, or relocation of the same, or any change in the borough plan by it deemed advisable; and it may make recommendations to council, from time to time, concerning any such matters and things aforesaid, for action by council thereon, and, in so doing, have regard for the present conditions and future needs and growth of the borough, and the distribution and relative location of all the principal and other streets and railways, waterways and all other means of public travel and business communications, as well as the distribution and relative location of all public buildings, public grounds, and open spaces devoted to public use.

Section 1148. Recommendations to Private Persons, Et Cetera.—The Borough Planning Commission may make recommendations to any public authorities or any corporations or individuals in said boroughs with reference to the location of any buildings, structures, or works to be erected or constructed by them.

Section 1149. Plans of Lots, Et Cetera, to Be Submitted Before Recording; Approval of Sewers, Et Cetera.—All plans, plots, or replots of lands laid out in building lots, and the streets or other portions of the same,

intended to be dedicated to public use, or for the use of purchasers or owners of lots fronting thereon or adjacent thereto, and located within the borough limits, shall be submitted to the Borough Planning Commission, and approved by it, before they shall be recorded. And it shall be unlawful to receive or record such plan in any public office, unless the same shall bear thereon, by endorsement or otherwise, the approval of the Borough Planning Commission. The disapproval of any such plan by the Borough Planning Commission shall be deemed a refusal of the proposed dedication shown thereon. The approval of the commission shall be deemed an acceptance of the proposed dedication, but shall not impose any duty upon the borough concerning the maintenance or improvement of any such dedicated parts, until the proper authorities of the borough shall have made actual appropriations of the same by entry, use, or improvement. No sewer, water, or gas main or pipes, or other improvement, shall be voted or made, within the area under the jurisdiction of said commission, for the use of any such purchasers or owners, nor shall any permit for connection with, or other use of, any such improvement existing, or for any other reason made, be given to any such purchasers or owners, until such plan is so approved.

Section 1150. Exercise of Planning Commission; Functions by Other Agencies.—It shall be proper for said boroughs to provide by ordinance for the exercise of all rights and powers herein conferred upon the Borough Planning Commission, by a park commission, or kindred municipal bureau or commisson, authorized under existing laws.

BOROUGH ZONING COMMISSION ENABLING ACT

Borough Code, 1947, Sections 3301 to 3310, inclusive

Article XXXIII

ZONING

Section 3301. Grant of Power.—For the purpose of promoting health, safety, morals or the general welfare, councils of boroughs are hereby empowered to regulate and restrict the height, number of stories, and size of buildings and other structures, their construction, alteration, extension, repair, maintenance, and all facilities and services in or about such buildings and structures and percentage of lot that may be occupied, the size of yards, courts and other open spaces, the density of population, and the location and use of buildings, structures, and land for trade, industry, residence or other purposes, and may also establish and maintain building lines and set back building lines upon any or all public streets.

Section 3302. Districts; Procedure.—(a) For any or all said purposes, the council may divide the borough into districts, of such number, shape, and area as may be deemed best suited to carry out the purpose of this article. Within such districts it may regulate and restrict the erection,

construction, reconstruction, alteration, repair or use of buildings, structures or land. All such regulations shall be uniform for each class or kind of buildings throughout each district, but the regulations in one district may differ from those in another district.

(b) The council shall provide by ordinance the manner in which the boundaries of such districts shall be determined and established and from time to time amended or changed. However no such boundary shall become effective until after public hearing in relation thereto at which parties in interest and citizens shall have an opportunity to be heard. At least fifteen days' notice of the time and place of such hearing shall be published in a newspaper of general circulation in such borough.

Section 3303. Purpose in View.—Such regulations shall be made in accordance with a comprehensive plan, and designed to lessen congestion in the streets, to secure safety from fire panic and other dangers, to promote health and the general welfare, to provide adequate light and air, to prevent the overcrowding of land, to avoid undue concentration of population, to facilitate the adequate provision of transportation, water, sewerage, schools, parks, and other public requirements. Such regulations shall be made with reasonable consideration, among other things, to the character of the district and its peculiar suitability for particular uses, and with a view to conserving the value of buildings and encouraging the most appropriate use of land throughout the borough.

Section 3304. The council shall exercise the powers granted in Section 3301 hereby by ordinance which shall provide for effecting of its purposes and for the enforcement of the regulations and restrictions established therein by reasonable fines and by the instituting appropriate actions or proceedings at law or in equity. At least one week and not more than three weeks prior to the presentation of the proposed ordinance an information notice of intention to consider such proposed ordinance and a brief summary setting forth the principal provisions of the proposed ordinance in such reasonable detail as will give adequate notice of its contents, pursuant to a uniform form which shall be prepared or approved by the Department of Internal Affairs, and a reference to the place or places within the borough where copies of the proposed ordinance may be examined shall be published in the manner provided by law for the publication of ordinances.

The provisions of the ordinance need not be advertised or recorded as in other cases. Provisions respecting the construction, alteration, extension, repair, care, and maintenance of buildings and structures may be supplied by reference to a standard building code approved by the Department of Internal Affairs, or to parts thereof determined by the council or such provisions of the ordinance may be supplied by reference to a typed or printed building code prepared under the direction of, or accepted by, the council, or such provisions may consist of a standard code approved as aforesaid or parts thereof and also further provisions typed or printed as aforesaid. Copies of the provisions of the ordinance thus adopted by reference shall be made available to any interested party at the cost thereof, or may be furnished or loaned without charge and a copy of such provisions of the ordinance whether by reference to a standard building code, or com-

bination of them shall be attached to the ordinance book with the same force and effect as if duly recorded therein.

The procedure set forth relating to the adoption of the ordinance may likewise be adopted in amending, supplementing or repealing any of the provisions of the ordinance.

Section 3305. Changes.—Such regulations, restrictions, and boundaries may from time to time be amended, supplemented, changed, modified or repealed. In case, however, of a protest against such change, signed by the owners of twenty percent or more, either or the area of the lots included in such proposed change or of those immediately adjacent in the rear thereof extending one hundred feet therefrom, or of those directly opposite thereto, extending one hundred feet from the street frontage of such opposite lots, such amendment shall not become effective except by the favorable vote of three-fourths of all the members of council.

Section 3306. Zoning Commission.—In order to avail itself of the powers conferred by this act, the council shall appoint a commission of five citizens, to be known as the Zoning Commission, to recommend the boundaries of the various original districts and appropriate regulations to be enforced therein. Such commission shall make a preliminary report and hold public hearings thereon before submitting its final report, and such council shall not hold its public hearings or take action until it has received the final report of such commission. Where a borough planning commission already exists it may be appointed as the zoning commission.

Section 3307. Board of Adjustment.—The council may appoint a board of adjustment, and, in the regulations and restrictions adopted pursuant to the authority of this article may provide that said board of adjustment may in appropriate cases, and subject to appropriate conditions and safeguards, make special exceptions to the terms of the ordinance in harmony with its general purpose and intent and in accordance with general or specific rules therein contained.

The board of adjustment shall consist of three members, one of whom shall be designated to serve until the first day of January following the adoption of the zoning ordinance, one until the first day of the second January thereafter, and one until the first day of the third January thereafter. Their successors shall be appointed on the expiration of their respective terms, to serve three years. The members of the board shall be removable for cause by the appointing authority upon written charges and after public hearing. Vacancies shall be filled for the unexpired term of any member whose term becomes vacant.

The board of adjustment shall adopt rules in accordance with the provisions of any ordinance adopted pursuant to this article. Meetings of the board shall be held at the call of the chairman, and at such other times as the board may determine. Such chairman, or in his absence the acting chairman, may administer oaths and compel the attendance of witnesses. All meetings of the board shall be open to the public. The board shall keep minutes of its proceedings showing the vote of each member upon each question, or, if absent or failing to vote, indicating such fact, and shall keep

records of its examinations and other official action, all of which shall be immediately filed in the office of the board and shall be a public record.

Appeals to the board of adjustment may be taken by any person aggrieved or by any officer of the borough affected by any decision of the administrative officer. Such appeal shall be taken within a reasonable time as provided by the rules of the board, by filing with the officer from whom the appeal is taken and with the board of adjustment a notice of appeal specifying the grounds thereof. The officer from whom the appeal is taken shall forthwith transmit to the board all the papers constituting the record upon which the action appealed from was taken.

An appeal shall stay all proceedings in furtherance of the action appealed from, unless the officer from whom the appeal is taken certifies to the board of adjustment, after the notice of appeal shall have been filed with him, that by reason of facts stated in the certificate a stay would in his opinion cause imminent peril to life and property. In such case proceedings shall not be stayed otherwise than by a restraining order, which may be granted by the board of adjustment or by a court of record on application on notice to the officer from whom the appeal is taken and due cause shown.

The board of adjustment shall fix a reasonable time for the hearing of the appeal, give public notice thereof as well as due notice to the parties in interest, and decide the same within a reasonable time. Upon the hearing, any party may appear in person or by agent or by attorney.

The board of adjustment shall have the following powers:

(1) To hear and decide appeals where it is alleged there is error in any order, requirement, decision or determination made by an administrative official in the enforcement of this article or of any ordinance adopted pursuant thereto.

(2) To hear and decide special exceptions to the terms of the ordinance upon which such board is required to pass under such ordinance.

(3) To authorize upon appeal in specific cases such variance from the terms of the ordinance as will not be contrary to the public interest, where owing to special conditions a literal enforcement of the provisions of the ordinance will result in unnecessary hardship, and so that the spirit of the ordinance shall be observed and substantial justice done.

In exercising the above mentioned powers, such board may in conformity with the provisions of this article reverse or affirm, wholly or partly, or may modify the order, requirement, decision or determination appealed from, and may make such order, requirement, decision or determination as in its opinion ought to be made. Notice of such decision shall forthwith be given to all parties in interest.

Any person aggrieved by any decision of the board of adjustment, or any taxpayer or any officer of the borough, may within thirty days after such decision of the board appeal to the court of common pleas of the county by petition, duly verified, setting forth that such decision is arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law and specifying the grounds upon which he lies.

Upon presentation of the petition in proper form, the court shall forthwith issue a writ of certiorari directed to the board of adjustment command-

ing it within twenty (20) days after the service thereof to certify to the court under the certificate of its chairman, its entire record in the matter in which the appeal has been taken. The prothonotary shall serve the board of adjustment by registered mail with a copy of the writ and a copy of the appeal petition. On or before the return day of the writ the board of adjustment shall file the entire record with the writ in the office of the prothonotary.

Any time during the pendency of an appeal, upon application of the appellant and upon due notice to the board of adjustment, the court, or a judge thereof, may after hearing grant an order of supersedeas upon such terms and conditions, including the filing of security, as the court or the judge thereof may prescribe.

If upon the hearing of the appeal it shall appear to the court that testimony is necessary for the proper disposition of the appeal, it may take evidence or appoint a referee to take such evidence as it may direct and report the same to the court, with his findings of facts and conclusions of law. The court may reverse, or affirm, in whole or in part, or may modify the decision appealed from as to it may appear just and proper.

Costs shall not be allowed against the board unless it shall appear to the court that it acted with gross negligence or in bad faith or with malice in making the decision appealed from.

Section 3308. Remedies.—In case any building or structure is erected, constructed, reconstructed, altered, repaired, converted or maintained, or any building, structure or land is used in violation of this article or of any ordinance or other regulation made under authority conferred hereby, the proper local authorities of the borough, in addition to other remedies, may institute any appropriate action or proceedings to prevent such unlawful erection, construction, reconstruction, alteration, repair, conversion, maintenance or use, to restrain, correct or abate such violation, to prevent the occupancy of said building, structure or land or to prevent any illegal act, conduct, business or use in or about such premises.

Section 3309. Certain Buildings of Public Utility Corporations Exempted.—This article shall not apply to any existing or proposed building or extension thereof used or to be used by public utility corporations, if upon petition of the corporation, the Public Utility Commission shall, after a public hearing, decide that the present or proposed situation of the building in question is reasonably necessary for the convenience or welfare or the public.

Section 3310. Finances.—The council is empowered to appropriate out of the general borough fund such moneys, otherwise unappropriated, as it may deem fit, to finance the work of the borough zoning commission and the board of adjustment, and to enforce the zoning regulations and restrictions which are adopted, and to accept grants of money and service for these purposes from either private or public sources, State or Federal.

TOWNSHIP PLANNING COMMISSION ENABLING ACT

The First Class Township Law Act No. 569, of May 27, 1949

As Amended

Article XXXII

TOWNSHIP PLANNING COMMISSION

Section 3201. Power to Create Planning Commission; Residence of Commissioners; Employes; Rules and Regulations.—The township commissioners may create by ordinance and appoint a planning commission, consisting of five persons. In the first instance, one member of said commission shall be appointed for one year, one for two years, one for three years, one for four years, and one for five years, and annually thereafter a member of said commission shall be appointed for a term of five years. An appointment to fill a vacancy shall be for the unexpired portion of the term. All members of the commission shall reside within the township. They shall serve without compensation, and make annually to the township commissioners a report of their transactions. The planning commission may, with the consent of the township commissioners, retain the services of an engineer or engineers, as well as other necessary employes, and may contract for professional planning services, the costs and expenses of which, when approved by the township commissioners, shall be provided for through proper appropriations. The township commissioners shall appropriate such sum as they deem necessary for defraying the expenses of the planning commission, and, in no event, shall the expenses of the planning commission, including the salaries of the engineer of other employes, exceed the amount of the appropriation.

Section 3202. Maps and Plans; Recommendations of Planning Commission.—In addition to filing an annual report, it shall be the duty of the planning commission to make, or cause to be made, and to lay before the township commissioners maps and plans of the township, or any portion thereof, showing the streets and other natural and artificial features, and also any locations recommended by it for any new public buildings, civic schemes, parkways, playgrounds, or any other public grounds or public improvements, and any widening, extension, or relocation of the same, and thereafter, from time to time, the planning commission may lay before the township commissioners any modification, change, or supplement to any prior plan or plans. The planning commission may also, from time to time, make recommendations to the township commissioners with respect to any and all matters and things referred to in this section, and, in so doing, shall have regard for the present conditions and future needs and growth of the township.

Any maps or plans so submitted shall not be effective unless regularly approved and adopted by ordinance or resolution of the township commissioners, and after such approval and adoption shall be subject to revision and change from time to time as the township commissioners may deem expedient.

Section 3203. Reference of Proposals to Planning Commission.—The township commissioners may, at their discretion, from time to time, submit to the planning commission any question or proposal relating to any of the matters or things referred to in the preceding section hereof, or any other matter or thing relating to the growth or development of the township, including any plans for the development of any particular sections of the township, and it shall be the duty of the planning commission, in due course, to make a report with respect to any such question or proposal, with its recommendation thereon.

TOWNSHIP ZONING COMMISSION ENABLING ACT

The First Class Township Law Act No. 569, of May 27, 1949

As Amended

Article XXXI

ZONING

Section 3101. Grant of Power.—For the purpose of promoting health, safety, morals, or the general welfare of townships, the boards of township commissioners are hereby empowered to regulate and restrict the height, number of stories, and size of buildings and other structures, their construction, alteration, extension, repair, maintenance, and all facilities and services in or about such buildings and structures, and percentage of lot that may be occupied, the size of yards, courts, and other open spaces, the density of population and the location and use of buildings, structures, and land for trade, industry, residence, or other purpose; and may also establish and maintain building lines and set back building lines upon any or all public streets and highways.

Section 3102. Districts.—(a) For any or all said purposes, the board of township commissioners may divide the township into districts of such number, shape, and area as may be deemed best suited to carry out the purpose of this article. Within such districts, it may regulate and restrict the erection, construction, reconstruction, alteration, repair, or use of buildings, structures, or land. All such regulations shall be uniform for each class or kind or buildings throughout each district, but the regulations in one district may differ from those in another district.

Section 3103. Purpose in View.—Such regulations shall be made in accordance with a comprehensive plan, and designed to lessen congestion in the streets, to secure safety from fire, panic, and other dangers, to promote health and the general welfare, to provide adequate light and air and to prevent the overcrowding of land, to avoid undue concentration of population, to facilitate the adequate provision of transportation, water, sewerage, schools, parks, and other public requirements. Such regulations shall be made with reasonable consideration, among other things, to the character of the district and its peculiar suitability for particular uses, and with a view to conserving the value of buildings and encouraging the most appropriate use of land throughout such township.

Section 3104. Methods of Procedure.—The board of township commissioners of such township shall provide, by ordinance, the manner in which such regulations and restrictions and the boundaries of such districts shall be determined, established, and enforced, and, from time to time, amended, supplemented, or changed. However, no such regulation, restriction, or boundary shall become effective until after a public hearing, in relation thereto, at which parties in interest and citizens shall have an opportunity to be heard. Notice of the time and place of such hearing shall be published in an official paper or a paper of general circulation in such township once a week for two weeks.

Section 3105. Changes.—Such regulations, restrictions, and boundaries may, from time to time, be amended, supplemented, changed, modified, or repealed. In case, however, of a protest against such change, signed by the owners of twenty per centum or more, either of the area of the lots included in such proposed change, or of those immediately adjacent in the rear, or in the front, or to either side thereof, extending one hundred feet therefrom. Such amendments shall not become effective except by the favorable vote of three-fourths of all the members of the board of township commissioners. The provisions of the previous section relative to public hearings and official notice shall apply equally to all changes or amendments.

Section 3106. Zoning Commission.—In order to avail itself of the powers conferred by this article, the board of township commissioners shall appoint a commission of five citizens, to be known as the Zoning Commission, to recommend the boundaries of the various original districts and appropriate regulations to be enforced therein. Such commission shall make a preliminary report and hold public hearings thereon before submitting its final report; and such board of township commissioners shall not hold its public hearings or take action until it has received the final report of such commission. Where a township planning commission exists, it may be appointed as the Zoning Commission.

Section 3107. Board of Adjustment.—Such board of township commissioners may appoint a board of adjustment, and, in the regulations and restrictions adopted pursuant to the authority of this article, may provide that said board of adjustment may, in appropriate cases and subject to appropriate conditions and safeguards, make special exceptions to the terms of the ordi-

nance in harmony with its general purpose and intent and in accordance with general or specific rules therein contained.

The board of adjustment shall consist of three members, one of whom shall be designated to serve until the first day of January following the adoption of the zoning ordinance, one until the first day of the second January thereafter, and one until the first day of the third January thereafter. Their successors shall be appointed on the exiration of their respective terms, to serve three years. The members of the board shall be removable for cause, by the appointing authority, upon written charges and after public hearing. Vacancies shall be filled for the unexpired term of any member whose term becomes vacant.

The board of adjustment shall adopt rules in accordance with the provisions of any ordinance adopted pursuant to this article. Meetings of the board shall be held at the call of the chairman, and at such other times as the board may determine. Such chairman or, in his absence, the acting chairman may administer oaths, and compel the attendance of witnesses. All meetings of the board shall be open to the public. The board shall keep minutes of its proceedings, showing the vote of each member upon each question, or if absent or failing to vote, indicating such fact, and shall keep records of its examinations and other official actions, all of which shall be immediately filed in the office of the board and shall be a public record.

Appeals to the board of adjustment may be taken by any person aggrieved, or by any officer of the township affected by any decision of the administrative officer. Such appeal shall be taken within a reasonable time, as provided by the rules of the board, by filing with the officer from whom the appeal is taken, and with the board of adjustment, a notice of appeal specifying the grounds thereof. The officer from whom the appeal is taken shall forthwith transmit to the board all the papers constituting the record upon which the action appealed from was taken.

An appeal stays all proceedings in furtherance of the action appealed from, unless the officer from whom the appeal is taken certifies to the board of adjustment, after the notice of appeal shall have been filed with him, that, by reason of facts stated in the certificate, a stay would, in his opinion, cause imminent peril to life and property. In such case, proceedings shall not be stayed otherwise than by a restraining order, which may be granted by the board of adjustment, or by a court of common pleas of the county on application, on notice to the officer from whom the appeal is taken, and due cause shown.

The board of adjustment shall fix a reasonable time for the hearing of the appeal, give public notice thereof, as well as due notice to the parties in interest, and decide the same within a reasonable time. Upon the hearing, any party may appear in person, or by agent or by attorney.

The board of adjustment shall have the following powers:

(1) To hear and decide appeals where it is alleged there is error in any order, requirement, decision, or determination made by an administrative official in the enforcement of this article or of any ordinance adopted pursuant thereto;

(2) To hear and decide special exceptions to the terms of the ordinance upon which such board is required to pass under such ordinance;

(3) To authorize, upon appeal, in specific cases, such variance from the terms of the ordinance as will not be contrary to the public interest, where, owing to special conditions, a literal enforcement of the provisions of the ordinance will result in unnecessary hardship, and so that the spirit of the ordinance shall be observed and substantial justice done.

In exercising the above mentioned powers, such board may, in conformity with the provisions of this article, reverse or affirm, wholly or partly, or may modify the order, requirement, decision, or determination appealed from, and may make such order, requirement, decision, or determination as ought to be made, and, to that end, shall have all the powers of the officer from whom the appeal is taken. Notice of such decision shall forthwith be given to all parties in interest.

Any person aggrieved by any decision of the board of adjustment, or any taxpayer, or any officer of the township, may, within thirty days after such decision of the board, appeal to the court of common pleas of the county by petition, duly verified, setting forth that such decision is arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law, specifying the grounds upon which he relies.

Upon the presentation of such petition, in proper form, the court shall forthwith issue a writ of certiorari, directed to the board of adjustment, commanding it, within twenty days after the service thereof, to certify to the court, under the certificate of its chairman, its entire record in the matter in which the appeal has been taken. The prothonotary shall serve the board of adjustment, by registered mail, with a copy of the writ and a copy of the appeal petition. On or before the return day of the writ, the board of adjustment shall file the entire record with the writ in the office of the prothonotary.

Any time during the pendency of the appeal, upon application of the appellant, and upon due notice to the board of adjustment, the court or a judge thereof may, after hearing, grant an order of supersedeas upon such terms and conditions, including the filing of security, as the court or the judge may prescribe.

If, upon hearing of the appeal, it shall appear to the court that testimony is necessary for the proper disposition of the appeal, it may take evidence or appoint a referee to take evidence as it may direct and report the same to the court with his findings of facts and conclusions of law. The court may reverse or affirm, in whole or in part, the decision appealed from as to it may appear just and proper.

Section 3108. Remedies.—In case any building, or structure is erected, constructed, reconstructed, altered, repaired, converted, or maintained, or any building, structure, or land is used in violation of this article or of any ordinance or other regulation made under authority conferred hereby, the proper officer of the township, in addition to other remedies, may institute, in the name of the township, any appropriate action or proceedings to pre-

vent such unlawful erection, construction, reconstruction, alteration, repair, conversion, maintenance, or use, to restrain, correct, or abate such violation, to prevent the occupancy of said building, structure, or land, or to prevent any illegal act, conduct, business, or use in or about such premises.

Section 3109. Conflict with Other Laws.—Whenever the regulations made under authority of this article require a greater width or size of yards, courts, or other open spaces, or require a lower height of buildings, or less number of stories, or require a greater percentage of lot to be left unoccupied, or impose other higher standards than are required in any other statute or local ordinance or regulation, the provisions of the regulations made under authority of this article shall govern. Wherever the provisions of any other statute or local ordinance or regulation require a greater width or size of yards, courts, or other open spaces, or require a lower height of building or a less number of stories, or require a greater percentage of lot to be left unoccupied, or impose other higher standards than are required by the regulations made under authority of this article, the provisions of such statute or local ordinance or regulation shall govern.

Section 3110. Act Not to Apply to Certain Buildings or Public Service Corporations.—This article shall not apply to any existing or proposed building, or extension therof, used or to be used by public service corporations, if, upon petition of the corporation, the Public Utility Commission shall, after a public hearing, decide that the present or proposed situation of the building in question is reasonably necessary for the convenience or welfare of the public.

REVISED TEXT OF "REGIONAL PLANNING AND ZONING ENABLING ACT"

Covering Cities of the 3rd Class, *Boroughs,* Incorporated Towns, and Townships, 1943 P. L. 340, 1945 P. L. 206 and P. L. 1339.

AN ACT

Section 1. The word "municipality" as used in this act shall include cities of the third class, boroughs, incorporated towns and townships.

Section 2. (Amendment of 1945). Two or more *adjoining* municipalities may jointly co-operate in the exercise and in the performance of their respective governmental powers, duties and functions and in carrying into effect provisions of law relating to said subjects which are common to all of such joining municipalities, and which each may, under existing law, separately exercise and perform. For the purpose of carrying the provisions of this act into effect the municipalities joining shall enter into such joint agreements as may be deemed appropriate for such purposes.

Section 3. Any joint agreement shall be deemed in force as to any particular municipality, when the same has been adopted by ordinance, or in the case of townships of the second class, by resolution. After adoption, any such agreement shall become binding upon the municipality, and the covenants thereof may be enforced by appropriate remedy by any one or more municipalities against any other municipality party thereto.

Section 4. (Amendment of 1945). Every such agreement shall set forth, inter alia, the particulars relating to the manner of cooperation, the means by and through which such cooperation shall be effectuated, including, if any, the employment of joint personnel, *the employment and retaining of planning engineers or consultants, the contracting for professional planning services* and the purchase of personal property and materials for the joint use of the municipalities, the allocation of the costs and expenses connected with the administration of the joint agreement upon an equitable basis, the term for which the agreement shall be in force, and the manner in which the same may be renewed for another term, and the manner in which joint property shall be disposed of or shared upon the termination of the agreement. Amendments to any agreement shall be adopted in the same manner as the original agreement.

Section 5. All joint purchases involving an expenditure of more than five hundred dollars ($500), shall be made by contract, in writing, only after notice for bids once a week for two weeks in at least one and not more than two newspapers of general circulation circulating generally in the joining municipalities. All contracts shall be let to the lowest responsible bidder.

Section 6. This act shall not be construed to authorize one municipality to delegate any of its powers, duties and functions to another municipality, nor to authorize one municipality to exercise such powers, duties or functions on behalf of another municipality.

Note: See also Section 507.2 to 507.4 of the County Planning and Zoning Enabling Act for specific authorization of regional planning activity.

RECORDING OF ZONING ORDINANCES

AN ACT

Requiring political subdivisions to file copies of zoning ordinances, together with maps or plans, indicating the area or zones of the political subdivision affected by such ordinances, in the recorder's office; invalidating zoning ordinances hereto adopted unless copies thereof, together with maps, are filed within a certain time; and imposing duties and conferring powers on recorders of deeds.

(Act 400, Approved May 14, 1949)

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 1. Every political subdivision of this Commonwealth authorized by law to adopt zoning ordinances restricting, regulating or otherwise affecting the use of real estate located within the boundaries of such political subdivision, shall file a copy of any such ordinance, or amendment thereto, certified to be true and correct by the proper officer, in the office for the recording of deeds of the county wherein the political subdivision is situate, together with a map or plan of the political subdivision, or part thereof, clearly delineating the affected areas or zones with a brief statement of the type or kind of restriction or regulation for each area or zone.

Section 2. Any zoning ordinance, or amendment thereto heretofore adopted by any political subdivision shall be void and of no effect unless such political subdivision shall comply with the provisions of this act within six months of the effective date hereof. No zoning ordinance hereafter adopted by any political subdivision, nor amendment to an existing zoning ordinance shall become effective until the political subdivision adopting the same shall have complied with the provisions of this act.

Section 3. It shall be the duty of the recorder of deeds of each county of this Commonwealth to provide a suitable "Zoning Ordinance and Map" book, or books, and to maintain an adequate index as part of the same, in which the filed copy of any such zoning ordinance, and amendments thereto, together with the map or plan of the political subdivision, or part thereof, shall be kept. The recorder of deeds shall charge the political subdivision filing the same a fee equal to the fees authorized by law for the same or similar services.

Section 4. All acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

Section 5. The provisions of this act shall become effective immediately.

SELECTED PUBLICATIONS OF THE PENNSYLVANIA STATE PLANNING BOARD

Publication No.

*1—Preliminary Report. 682 pages. 152 charts, December, 1934

*10—Drainage Basin Study. 3 vols., 611 pages, 1937.

15—Recent Industrial Trends and New Employment Opportunities in Pennsylvania.

16—Retail Trade in Pennsylvania, 1946.

17—Industrial Utility of Water in Pennsylvania. Chemical Character of Surface Water, 1944 to 1946. 1947

18—The Pennsylvania Zoning Primer (Revised), 1948.

19—Local Powers for Community Development, 1948.

20—A Pennsylvania Recreation Manual, 1949.

21—Planning and Zoning Powers and Procedures in Pennsylvania, 1949. Vol. 1. (Townships of the Second Class, Counties, Regions.)

22—Planning and Zoning Powers and Procedures in Pennsylvania, 1949. Vol. 2. (Cities, Boroughs, First Class Townships.)

These publications may be seen in representative public libraries. A limited number of those listed are available for distribution until the present supply is exhausted. Those marked with an asterisk are now out of print but may be seen in representative public libraries.

The following issues of **Pennsylvania Planning** are still available.

Local Tax Rates, May-June, 1940.

Community Self-Appraisal (Revised Edition), April, 1942.

Comparative County Data, May, 1942.

Planning and Zoning Progress in Pennsylvania, July, 1942.

Population, October, 1942.

Handicrafts in Post-War Planning, May, 1943.

Plastics, July, 1943.

Air Photographs, February, 1944.

Light Metals and Stainless Steel, August, 1944.

Topographic Mapping Needs, February, 1945. (For limited technical distribution.)

Community Action for Local Self Development, July, 1945.

Conservation, August, 1945.

Forest Resources, November, 1946.

Soil Conservation, September, 1947.

Minerals Conservation, December, 1948.

Know Your Pennsylvania, September, 1949.

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